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A New Look At Flow In Glass Tanks

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Introduction

One can obtain as many answers on flow in glass tanks as questions asked and many of us have had different ideas as to what is actually taking place in the glass tank and how currents can be harnessed and controlled to provide maximum efficiency to processing.

Certain accepted practices, however, have been followed in an attempt to control flow in continuous melting units and much will be found, in the literature, to be in direct conflict with this discussion. However, recent observations surrounding the conduct of flow in tanks where problems have existed and the ultimate solution of these problems warranted a fresh examination of what was taking place in glass tank flow.

The ideas advanced in this paper are in conflict with the literature and, therefore, may be controversial. It must be admitted they are unsupported by scientific proof but are the result of reason and logic, from personal experience and observation. This paper will deal with colored container glasses, principally amber, made in furnaces having a conventional straight throat and bridgewall construction. However, the theories expressed in respect to this case appear to be applicable to all colors of glass, including flint, that are made in tanks with bridgewall construction, irrespective of composition and substantiated somewhat by the performance of tanks having different construction.

It is hoped that these ideas will provide an additional incentive for reexamination of glass flow by those who are interested. Certainly, the glass container industry continues to be in need of more knowledge and additional tools to remain competitive and healthy.

Presented at the Sixteenth Conference on Glass Problems, University of Illinois, Urbana, Illinois, December 1 and 2, 1955.

Discussion of Present Practices

Before launching any discussion on new theories surrounding flow in glass tanks, it might be well to briefly review our present practice and what it is supposed to accomplish. On most container tanks, in the industry, an attempt is made to regulate flow by control of the furnace temperature gradient. This is especially true of side port tanks where, with four port construction, a hot point is usually created in the area of number 3 port, the temperature rapidly tapering off in both directions toward the bridgewall and toward the charging end. Generally a differential of 100° F. to 125° F. exists between number 1 port and the hot spot, whereas a differential 60° F. to 125° F. is maintained between this hot joint and the bridgewall, depending upon the shadow wall and the temperature requirements of the refiner.

Higher loads have made it necessary to push the actual temperatures higher and higher. Fortunately, the refractory manufacturers have come to the rescue and so the end point has apparently not yet been reached.

In return for regulating the temperature gradient in this manner, the glass flow is expected to confine itself, in the main, to two wheels both emanating from the point of maximum temperature, but one traveling in a counterclockwise direction toward the charging end on the surface and back to the hot point under the surface. The other wheel is supposed to continue from the hot point on the surface toward the bridgewall and back to the hot point underneath the surface.

Various sidewinding eddy currents, doubtlessly are taking place as evidenced by refractory erosion but these are believed to be of secondary importance. See Figure 1.

Figure 2 shows surface flow believed to be existing under present temperature gradients.

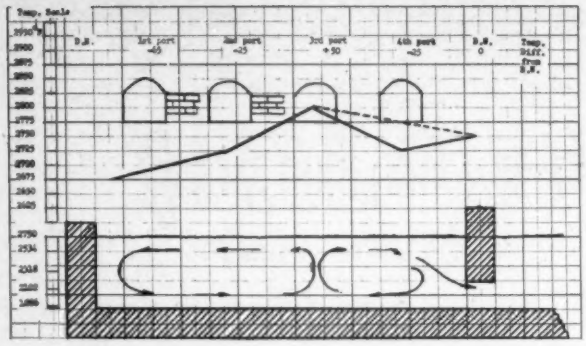


Fig. 1. Conventional heat curve.

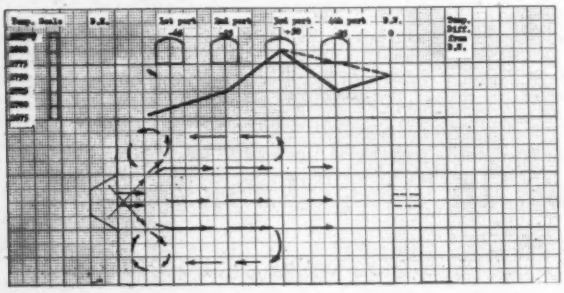


Fig. 2. Surface flow, conventional heat curve, side port furnace.

Even though we are in disagreement with their efficiency, it is not our intention to condemn these practices for they have been used a long time and with success. Rather, it is felt that they may be implemented and altered to provide an aid to melting and quality.

Chemistry Alone Is Insufficient

A good segment of the container industry is familiar with our work in the amber field wherein these glasses are balanced, iron and manganese to sulfur, in a ratio of 56:32, the atomic weights. In a vast majority of cases, to simply balance the batch has been sufficient and you are also familiar with the marked improvement in resulting quality.

However, there were several cases, the cause unrecognized in the beginning, where poor quality was obtained even when optimum conditions of batch balance had been instituted. Trial and error experimentation ultimately led to a study of glass flow; herein lay the solution to a very important portion of the problem.

Gradient Through Glass

Reliable published work by Holscher, Rough, and Plummer* show the gradient through amber glass to be 21.6° F./in. on commercial tanks. On flint glass the gradient is shown to be 7.6°/in. and on emerald green 25.2°/in. These data are of particular importance in this discussion because our present practice and furnace construction utilizes the full depth and if the currents proceed according to plan, we have a job of melting batch below the glass surface. An amber tank operating at 2750° F. on the glass surface will approximate 2000° F. on the bottom at 35 inch metal depth.

*Presented before the American Ceramic Society, Pittsburgh, April 21, 1943.

Mechanical Currents

Heavy pull demands, in recent years, have produced a situation where flow is no longer controlled, in the main, by convection currents. This condition is entirely different from what existed a few years ago when far lower pulls were the order of the day.

From glass quality, float studies, and scum formations, there is convincing proof that "mechanical currents" have taken over. Figure 3 will show how batch, even though it is perfectly balanced, can produce improperly melted glass of low quality. Furthermore, it is quite obvious that the glass cannot melt well when following a path through a low temperature zone, such as indicated in this figure. Many have discussed "selective melting", a term used in referring to a condition where fluxes have melted before silica. It is commonly accepted as occurring in conjunction with improper surface melting and often has been blamed on coarse sand, etc.

Instead of this being the reason for resulting silica scum, which is usually unaltered quartz, it appears quite logical that selective melting may be more readily explainable from the mechanical currents, illustrated in this figure.

We prefer to call the condition herein shown, "short circuiting". Time or lack of same becomes much more of a factor than ever before, in addition to a number of unfavorable conditions created. The furnace is more vulnerable to (1) Batch stones; (2) Any type of refractory stones originating from the superstructure and which cannot be taken into solution by virtue of being in low temperature zones; (3) Cord, by virtue of the creation of a dormant area of glass which will become high in silica from the phenomenon shown in Figure 3; (4) Load seed; (5) Blisters from two sources: (a) Passing through of undecomposed sulfate; (b) Partially decomposed sulfate in process of reacting with sulfides.

Floaters placed in furnaces suspected of short circuiting, invariably return promptly to the doghouse end wall, even when pushed forcibly to well within the first port area. Of course, this is exactly the situation attempting to be created by a conventional temperature gradient similar to that shown in Figure 1. Here is where issue is taken with the existing theories. By creating the two wheels shown in the first figure a deliberate attempt is being made to short circuit the batch.

Glass flow will be directly proportional to lack of resistance to such flow, which is another way of saying

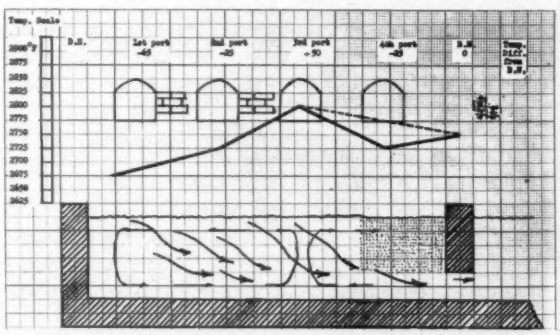


Fig. 3. Conventional heat curve with short circuiting.

flow will seek the direction of least viscosity. Herein lies the danger of too high doghouse temperatures, creating low viscosity and allowing batch to sink into the pattern of short circuit. If conventional theories were correct, this same batch or partially melted glass would rise to the surface at the furnace hot point. However, glass must flow from melter to refiner through the throat. Present construction creates a lateral flow at the furnace bottom, hence contributing to underflow.

The sinking of batch, partially melted glass, or thoroughly melted glass may occur at any point in the furnace depending upon the lack of resistance to flow. For example, if too pronounced cooling is allowed between the hot spot and bridgewall, a surface resistance to flow is likely to be created, causing the glass to sink at the hot spot and proceed directly toward the throat.

Probably the most influential mechanical force operating in the glass furnace is that caused by the glass pressure equalization between melter and refiner, through a throat located on the furnace bottom. Here is the major cause of short circuiting.

Surface Flow

To maintain batch on the tank surface for a maximum period of time is obviously the best course of action since here is the main heat source and chemical reactions will all be complete in minimum time. Accomplishment of this is often difficult since the forces herein described must be overcome. *End* port furnace operation provides an important clue and it is important that more study be given this operation.

End port furnaces have been good performers through the years as far as pull and glass quality are concerned. There is evidence that actually greater pulls are being undertaken with success on end ports than is the case on *side* ports. Upon examination of this operation, it is found that there is no attempt at maintaining temperature gradients bearing any similarity to those customarily used in side port operation. Usually, the hot spot is at or near the bridgewall simply because it is impossible to place in any other location.

Figure 4 shows a typical heat curve being used on an end port furnace. Using the theory expressed here, that flow will be toward the point of least resistance or low viscosity. Greater surface flow is established by continuously higher temperature toward the bridgewall as shown. Flow in the furnace is completely reversed from

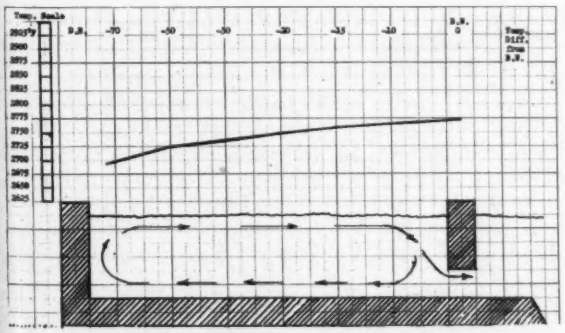


Fig. 4. Conventional heat curve, end port furnace.

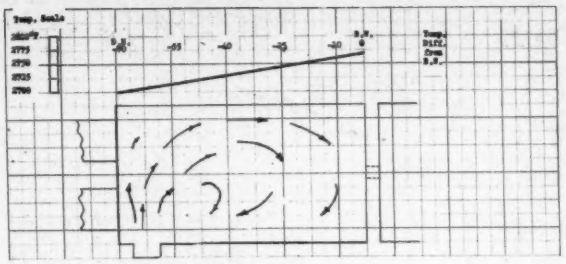


Fig. 5. Surface flow, end port furnace.

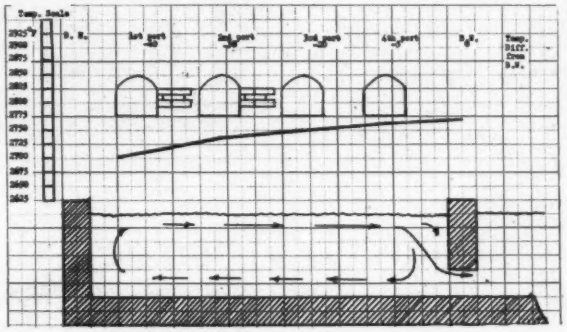


Fig. 6. Corrected heat curve, side port furnace.

that of side port tanks operated in conformance to temperatures shown in Figure 1. One large wheel moving laterally on the surface from doghouse to bridgewall has been established. The very maximum of batch exposure to heat source is created and the only undercurrent taking place is that returning from the bridge to doghouse. It is apparent that many end port operations have largely overcome the mechanical force established by pull at the throat. Figure 5 shows typical surface flow on end port operation.

Sampling of surface glass at the bridgewall area indicates active glass, providing the operator with a good indicator as to refiner glass quality several hours hence. Floater tests further verify good lateral surface flow.

Similarly, side port tanks may be operated to provide exactly the same condition except easier and more efficiently. Figure 6 shows a side port tank wtih temperature gradient so revised to almost agree with that of an end port furnace. It will be noted that the flow pattern is entirely changed and now reversed from that in Figure 1. This change is substantiated by the performance of floaters. In the conditions set up in Figure 1, they were inclined to proceed down the tank as far as the hot spot and then return along the side to doghouse end wall. Under these new conditions, floaters will proceed directly toward the bridgewall. All furnaces should be operated to establish active surface flow at bridgewall area.

These conditions are not theoretical and it should be stated that they have actually been placed in practice with marked success in glass quality improvement. By the same methods, stone losses have been reduced.

It is felt with this gradient, the overall temperature of the furnace may be reduced for simple reason of im-

(*Continued on page* 234)

Hotel Statler, Convention Headquarters

Glass Division Schedules Thirty Papers for Annual A. C. S. Meeting

● THE AMERICAN CERAMIC SOCIETY will hold its 58th Annual Meeting, April 22-26 in New York, with headquarters at the Hotel Statler. New York was host to the Society in 1953.

Of the thirty papers to be presented by the Glass Division, six will be given in a joint session with the Refractories Division. A total of one hundred and eighty-eight papers will be delivered at this national meeting.

Dr. J. F. Schairer, Carnegie Institution of Washington, will give the Orton Memorial Lecture at the general session the morning of Monday, the 23rd. Dr. Schairer's subject will be "Melting Relations of the Common Rock-Forming Oxides."

For the annual banquet the speaker will be Dr. Kenneth McFarland, nationally known educator and educational consultant to General Motors Corporation.

Presiding over this annual meeting will be Robert Twells, vice president of Electric Auto-Lite Company and president of the American Ceramic Society. Karl Schwartzwalder, director of research for the A C Spark Plug Division of General Motors, will be inaugurated to succeed to the presidency of the Society during the banquet.

John F. McMahon, dean of the College of Ceramics at Alfred University will be president-elect for the coming year.

To be installed as vice presidents will be Oscar G. Burch, Owens-Illinois Glass Company, Louis Navias, General Electric Research Laboratories and C. W. Planje of Gladding, McBean & Company.

The new treasurer of the Society will be Andrew Pereny of Pereny Equipment Company. Charles S. Pearce of Columbus, Ohio, continues as general secretary of the Society.

While this year's list of one hundred and eighty-eight technical papers is only slightly less than the one hundred and ninety-three presented at the last national meeting, it is supposed to reflect an effort by division program chairmen to allow more time for discussion. There are one hundred and eighty-three on the announced program, plus five supplementary papers.

Following is a list of the papers in the order of presentation to be given at the Glass Division sessions:

1. Morphology of Fractures in Polished Glass Surfaces. W. C. Levengood and W. E. Fowler, Libbey-Owens-Ford Glass Company, Toledo, Ohio.
2. Semi-Chemadsorbed Oxygen Monolayers and Non-wetting Glass Surfaces. Scott Anderson, The Anderson Physical Laboratory, Champaign, Ill.
3. The Amorphous Surface Layer on Finely Ground Crystalling Quartz. J. G. Sayre and J. W. Michener, Owens-Corning Fiberglas Corporation, Newark, Ohio.
4. Stress Measurement in Cylindrical Vessels. H. N. Ritland, Corning Glass Works, Corning, N. Y.
5. Viscous Flow in Glass-To-Metal Seals. H. E. Hagy and H. N. Ritland, Corning Glass Works, Corning, N. Y.
6. Theory of Viscous Flow of Glasses. Harold T. Smyth, School of Ceramics, Rutgers University, New Brunswick, N. J.
7. The Effect of Stress During Forming on the Strength of Glass. E. D. Lynch and F. V. Tooley, Department of Ceramic Engineering, University of Illinois, Urbana, Ill.
8. An Accurate Method for the Study of Ionic Diffusion in Glass. Rajeshwar K. Gupta and Robert L. Hess, University of Michigan, Ann Arbor, Mich.
9. A Re-evaluation of the Chemical Durability of Soda-Potash-Silica Glasses. Rajeshwar K.

(*Continued on page* 230)

Surface Protection of Malt Beverage Bottles By Silicones

By JAMES P. POOLE, Director of Research

Brockway Glass Company, Inc., Brockway, Pennsylvania

Introduction

The dependence of the strength of glass on the condition of its surface has long been appreciated by glass technologists. Of all the variables upon which the strength of glass depends, such as the surface condition, chemical composition, thermal history, sample size, test method, time and duration of test, etc., by far the most important is the surface condition or the type and number of flaws present there. For example, pristine glass has an intrinsic strength sufficient to withstand a breaking stress up to about 10,000 psi. Moderate handling will affect the surface enough to reduce the strength level by one-half! Unless extreme care is taken to maintain a constant surface condition, the effect of the other variables influencing strength cannot even be evaluated.

For this reason, the glass industry has for years been attacking the problem of strength preservation by research on techniques of surface treatment which would tend to minimize the development of surface abrasions through normal handling, thereby preserving the strength of the glass. The surface of glass, because of the phenomenon of cohesion, is most vulnerable to damage when it is emerging warm from the annealing lehr. Therefore, it is essential that this pristine surface be protected before the glass is handled and has had an opportunity to accumulate damage.

Consequently, all effective surface protective films are applied to the glass during the annealing process.

A protective film of sorts will be built up on the surface of glass as it ages because of moisture absorption and also because of the pick-up of grease from the hands of people handling the glass. At the same time, however, the glass has been accumulating abrasions and damage so that it is already weakened and the protective film is valueless as far as strength preservation is concerned. It will, of course, reduce cohesion, or "seizing", until the glass is washed and then, even this protection vanishes.

Surface treatments intended for strength preservation of glass containers range from sulfuring, through the application of organic and metal-organic soaps, greases, and resins, to plastic dipping. All such techniques are effective in varying degrees, but most are removed by washing and the clean glass is again vulnerable to surface damage. With the exception of metal-organic films (silicones are included here), and plastic dipping, all other protective films have to be removed by washing before the bottles are filled, either because of their appearance or because of their toxic or reactive behavior.

The purpose of this report is to describe the use of silicones as a method of preserving the surface of glass malt beverage bottles against damage by abrasion and impact, thereby preserving the original high intrinsic strength of the glass container. As the silicones used are inert, the protective film is virtually permanent. Good protection throughout the life of a one-trip container is realized, while the life of returnable bottles is greatly increased.

Several years of experimental and production experience with siliconed glassware have shown that the silicone films give better protection to glass than any other material yet developed. This embraces not only the field of glass containers but also fibres, flat glass, tubing, bulbs, and radio and television tubes.

Development

The Brockway Glass Company has been actively engaged in the surface treatment of glass containers for many years. It was among the first to use sulfur on one-way containers and began development work on the use of vegetable fats and oils for surface protection prior to 1940. Silicones were first tried in 1948 when the chlorosilanes became available, but the reactivity of this substance and its noxious by-products caused this work to be suspended until more practical silicones would become available. The results with silicones were significant enough even then, however, to make it obvious that experiments with silicones should be merely suspended and not abandoned.

In the meantime, studies were conducted on various organic soap-like materials such as oleates, stearates, palmitates, and laureates. These materials gave excellent initial protection and were invisible, but being water soluble, the protection afforded was only temporary.

Early in 1952, new silicones, the siloxanes, which had no reaction products other than silica and carbon dioxide, and which had been established as non-toxic, became available.

Surface treatment studies were immediately begun with these materials and, as a result, the SM70 emulsion was developed in May 1953, by General Electric for the Brockway Glass Company, specifically for application to glass containers.

Since that time, several other silicones have been developed which are applicable to the glass industry. Especially noteworthy are the Dow Corning materials: the #4010 emulsion and the #4141 fluid.

All three of these materials have been used for surface protection of glass containers, and each has its own spe-

cial merits. The advances in silicone materials for this purpose have been truly remarkable and even better silicone protective films for glass with a minimum of associated problems seem a certainty for the near future.

Silicone Applications

Great strides have been made in improving the technique of application of silicone to glass since the development began six years ago.

Considerable time is continually devoted to obtaining fundamental data on the application temperature and curing cycles required for the various silicones. The development of application techniques involves closely controlled applications to pristine glass at a number of temperatures for a number of different curing times, followed by the measurement of the lubricity, water repellency, durability to standard caustic concentrations, durability against steam autoclaving, feel and appearance of the container, and compatability with various adhesives, before the optimum treatment conditions can be established. This work must be repeated for every new silicone investigated. Product reactivity and extraction tests of the silicone from the container by the product under accelerated conditions are then carried out.

At present, our company has developed and has in operation three distinct types of silicone applications. Two of these apply to malt beverage bottles. By these techniques, it is possible to apply the silicone protective film as desired, on the outside of the container only, on all of the outside and only part of the inside, or completely inside and outside. These various treatments are necessary because of various visual phenomena resulting from silicone films as well as the varying requirements of various filling lines.

Lubricity Evaluation

It has been found that once the properties of a given silicone have been thoroughly investigated and established, lubricity measurements can be used to control the actual treatment.

These lubricity measurements are made by determining the frictional angle of repose of the top bottle of a pyramid of three bottles, all of which are siliconed.

The apparatus consists of a tray designed to hold two bottles firmly side by side in a horizontal position. A third bottle is placed on top completing the pyramid.

This bottle is exactly located on the other two by a reference stop. The tray holding the pyramid is mounted to the shaft of a motor driven gear reduction unit whose angular motion is calibrated in degrees. The motor is started and the tray begins to tilt. The angle at which the top bottle begins to slide is recorded. This is redetermined for all positions of all three bottles. The average of about 64 separate measurements is taken as the index of lubricity.

An alternate method by measuring the torque required to rotate the top bottle of the pyramid against the bottom two is now being developed.

Typical examples of this data appear in Table I. Using the standard 4 oz. wide-mouth baby food jars for easier handling and testing, these tests indicate angles of repose for jars treated with Dow-Corning #4010 silicone emulsion under optimum application conditions.

Table I

Index of Lubricity #4010

Sample Group	Untreated	Treated	Treated and Autoclaved (20 psi. 1 hr.)
1	Tumbled	9°	15°
2	Off	7½	14
3	Without	10	17½
4	Sliding	7½	14
5	+45°	6	14
6		9	15

It has been found that quantitative film evaluation and the ability to differentiate between types of silicones are possible by this technique. Therefore, it is used as a process control.

Advantages of Siliconed Containers

As was pointed out in the introduction, the prime purpose of siliconing a glass container is to preserve its high intrinsic strength by minimizing surface damage.

Surface damage is primarily the result of bottle to bot-

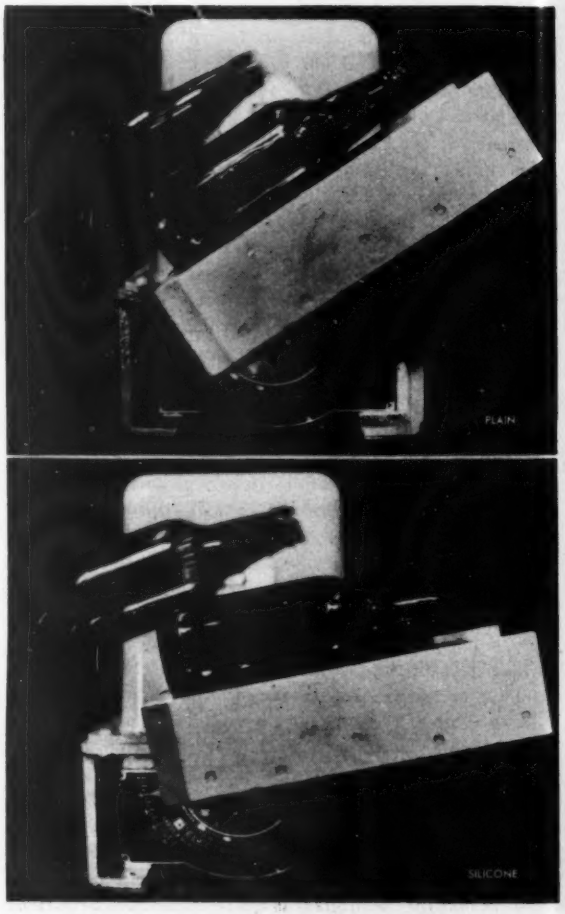


Fig. 1. Apparatus for evaluation of glass to glass lubricity of surface coatings by determination of angle of repose. Plain bottles slide at around a 30-degrees tilt, but the improved lubricity provided by a silicone coating reduces that angle to less than 10 degrees. This increased "slip" makes heated bottles easier to handle, especially by automatic filling and packaging machinery.

tle abrasion and impacts. The first type is practically eliminated by the silicone film, although repeated friction on the same spot will eventually wear through the film. Even then the type of damage is different as the silicone still prevents seizing which results in sharp, fissure-like surface cracks.

The silicone film is not proof against direct impact but many types of impact, if directed at an angle less than 90°, will be converted into glancing blows by the lubricity of the film and thus be rendered harmless.

Proof of the strength preserving ability of the silicone film is best illustrated by actual test data which are included in a later section. However, advantages other than reduction in surface damage do result from the use of siliconed containers.

For example, better pressure retentions with easier cap removal and less cork residue in the finish will result. Rinse water drain-out from a siliconed bottle is more complete. Chemical durability of the bottle to distilled water and acid is improved about 15%. Smoother line operation is possible as siliconed bottles are self-lubricating. Consequently, less jamming will occur at unscramblers and other constrictions in the line. This will result in quieter operation and permits an increased line speed.

However, by far the biggest advantage to siliconed containers is their high strength which leads to decreased line, shipping, and trade breakage. The major savings resulting from this decreased breakage result from the decreased filling line down time and product loss.

Production Tests

National Brewing Company

The effectiveness of the silicone surface coating is best illustrated by an examination of production test results.

The first production test was made on Mold #1596 12 oz. Export Shape one-way beer bottles at the National Brewing Company in Baltimore, Maryland. This test consisted of duplicate runs of 300 cases each of sulfured and siliconed ware. For damage and strength determinations, two dozen of both sulfured and siliconed bottles were taken at random from the line after the first unscrambler, rinser, capper, pasteurizer, labeller, and case loader. The performance during the run was determined by competent observers stationed at various points on the line.

Sample bottles obtained from the line were brought to Brockway for further examination and testing.

Two bottles from each sampling point were etched in hydrofluoric acid, examined visually, and photographed. The abrasions made apparent by the acid etching enables one to visually estimate the damage imparted to the bottle up to the sampling point on the line.

The remaining bottles were then tested on the Preston Increment Pressure tester until breakage occurred. These results confirm the strength differences which can be predicted from an examination of the etched samples.

Line Performance

At the conclusion of the test run, the various observers commented on the general performance of the two types of ware through the line.

It was noted that the siliconed bottles spun more on the chain belt, ran smoothly with no tendency to jam, (in fact, they unjammed themselves at unscrambler necks), ran very quietly, and in general showed considerably better line behavior than the sulfured bottles.

A condensation film was observed on the outside of the bottle as it entered the pasteurizer. Upon exit from the pasteurizer, an inside condensation film was noticeable. This appearance was considered objectionable and has since been eliminated by confining the silicone film entirely to the outside of the bottle. These bottles were only rinsed. If they had gone through a caustic soaker which removes the water repellency responsible for fogging (but does not affect the protection provided by the film) this appearance problem would not have occurred.

The bottles were also found to have a dirty appearance at the pasteurizer exit. This was traced to lubricating bar soap pick-up from the worm feed screws at the rinser and filler and is eliminated by liquid lubrication and maintaining clean worm feeds.

Several bottles fell out of the rinser pockets during the test. The siliconed bottles bounced on the concrete floor while the sulfured bottles smashed.

Actual breakage figures for the run are given in Table II:

Table II

Breakage or Short Fills

	Regular Sulfured	Siliconed
Unscrambler	3	2
Rinser	2	0
Filler	2	0
Crowner	8	0
Short at Filler	39	0
Pasteurizer	9	3
Unscrambler	1	0
Short at Pasteurizer	74	46
Label	3	0
Packer	1	4
Warehouse	2	0
Total Broken	31	9
Total Short	113	46
Total Packed	6874	6940
Total Run	7018	6995
Percent Broken	.44%	.13%
Percent Short	1.51%	.66%
Percent Packed	97.95%	99.21%

The short fills occur at a start-up and after breakage. Since none of the siliconed bottles broke in the filler or capper (an unusual event for this many bottles), the 46 short fills for the siliconed bottles occurred at the start-up. About the same number of shorts should have resulted for the sulfured bottles at the start so that the shorts due to breakage are probably about 28 bottles. It is also possible that the 39 mentioned short at the filler were not removed and are included in the 74 found at the pasteurizer. Even so, the preservation of strength resulting from the silicone is quite apparent in the results.

Line Damage

The samples that were acid etched showed clearly that the silicone film decreased greatly the amount of abrasion or damage picked up by the bottles on their trip through the line. Photographs of these bottles are included and

show that the damage is concentrated in three zones around the sidewall of the bottle. Past experience has shown that as the strength of the bottle is primarily dependent upon its surface condition, a rough estimate of strength can be made by observing bottle abrasions.

Figures 2, 3, 4, and 5 show sulfured and siliconed bottles after the first unscrambler and labelling. The differences in surface damage are quite apparent.

Fig. 2. Sulfured Bottle after first Unscrambler.

Fig. 3. SM-70 Siliconed Bottle after first Unscrambler.

Fig. 4. Sulfured Bottle after Labelling.

Fig. 5. SM-70 Siliconed Bottle after Labelling.

Figures 6 and 7 show the same bottle with a different silicone treatment before and after one trip through this same line. This is a recent test and presented to show the improvement in silicones and application techniques since the first test was made. Production data for this type of silicone was obtained under actual production conditions, through tests which were conducted by Canadian Breweries, Limited.

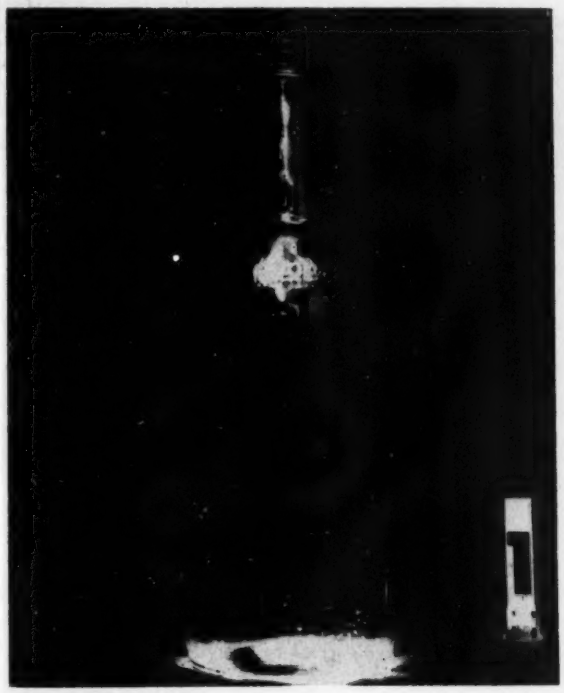


Fig. 6. DC 4141 as received.

Fig. 7. DC 4141 after case loading.

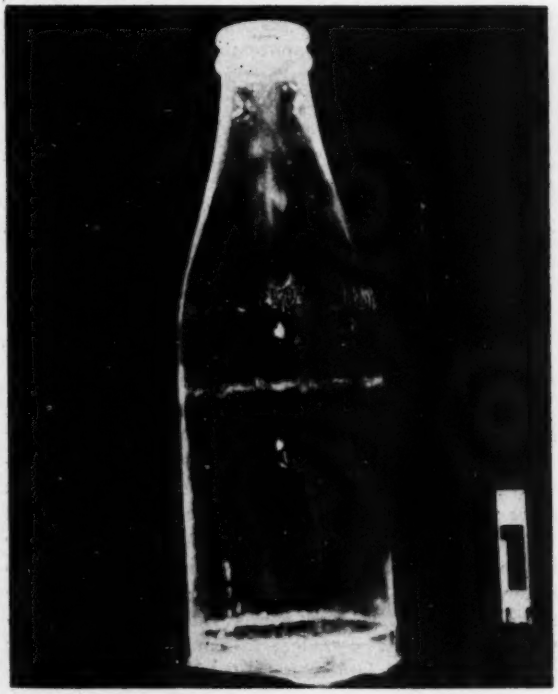


Fig. 8. Sulfured O'Keefe's after case loading.

Fig. 9. DC 4141 O'Keefe's after case loading.

Pressure Tests

The correlation between surface damage and strength is shown in Table III which presents the average* pressure strengths of the bottles taken at the various sampling points.

Table III

Position	Regular Sulfured	Siliconed	% Increased
Unscrambler	278 psi	280 psi	.7%
Rinser	255	295	15.7
Capper	235	260	10.6
Pasteurizer	248	250	14.3
Labeller	224	275	22.8
Case Loader	242	278	14.9

*(Detailed results for each bottle are on file.)

In spite of the fact that this treatment was applied over a trace of sulfur which decreases the lubricity of the silicones, the range of strength improvement shown is significant. The permanency of the protection provided by the silicone is also obvious as the same strength level is maintained throughout the line.

Production Test

Canadian Breweries, Ltd.

About ten cars of siliconed 10 oz. capacity bottles have been run by the Canadian Breweries, Ltd. at several of their plants. These bottles were run through a returnable line containing a soaker with the following breakage results being typical.

Table IV

April 14, 1955 Position	Siliconed	3,113 cases Sulfured
Rinser	2	46
Filler	0	37
Pasteurizer	20	200
Labellers	4	29
Packer	2	29
Total Breakage	28	391
Percent of Breakage	0.037%	0.52%
Total Bottles	74,712	74,712

Table V

Hydrostatic Pressure Strength

	Siliconed	Sulfured
As manufactured	384 psi	342 psi
After 1 trip and shipping	347	242
% Loss in strength	9.6%	29.1%

These results, startling as they are, have been duplicated in many tests on many different types of products. It is excellent confirmation of the fact that strength is dependent upon surface damage.

Incline Impact Tests

The following is a report of Incline Impact Tests made by the Container Laboratories, Inc. for the Container Corporation of America. Bottles used in this test are the same as those from the National Brewing Company discussed above.

Container Corporation of America — Project No. 9108
New York, New York — January, 1955

Object

(1) To deterimine and compare the relative durability of two different types of 12 oz. export-type one-way bottles for National Bohemian Beer. One type consisted of regular bottles and the other type consisted of silicone-coated bottles.

(2) To determine and compare the protection afforded the bottles by two different types—one present and one proposed—of 6-pack folding boxboard carrier cartons packed four to a corrugated fibreboard tray.

Synopsis

The test results disclosed that the silicone-coated bottles were considerably better than the regular bottles insofar as average resistance to impacts was concerned. There was little to choose between the two types of 6-pack folding boxboard carriers evaluated. The present carriers sustained fewer impacts to bottle breakage but had a smaller total number of broken bottles than were recorded for the proposed carriers.

Materials Tested

The materials tested consisted of a total of thirty-two fully packed corrugated fibreboard trays. Each tray contained four, 6-pack folding cartons each designed for six, one-way bottles of 12 oz. National Bohemian Beer. The material was divided into four groups of eight boxes each and designated as follows:

1. Present 6-pack carrier with regular bottles.
2. Present 6-pack carrier with silicone-coated bottles.
3. Proposed 6-pack carrier with regular bottles.
4. Proposed 6-pack carrier with silicone-coated bottles.

All corrugated fibreboard trays were identical and had kraft facings with C-flute corrugations. All trays had stapled corners and had approximate inside dimensions of 16⅜" x 10¾" x 4¾". The trays were printed "4—6-pack Cartons, No Deposit, National Bohemian—The National Brewing Company, Baltimore, Maryland."

Each tray was fitted with four, 6-pack bottle carriers. All carriers were equipped with carrying handles.

Each tray contained a total of twenty-four 12 oz. one-way export-type bottles, packed six to a carrier. The bottles were arranged six along the length of the tray by four along the width by one deep.

Method of Tests

Incline Impact Tests

This test simulates the stresses applied to merchandise in a carrier, such as a freight car or truck, when the latter is subjected to suddent starts or stops. It consists essentially of releasing a loaded container, mounted on a moveable platform dolly which rides on a plane inclined 10° from the horizontal, from a known distance up the incline and permitting it to strike against a fixed backstop at the bottom of the plane and perpendicular to it. The magnitude of impact shock can be varied by using different release points. Damages to contents and container resulting from the impact are noted.

(*Continued on page* 220)

Wetting Phenomena — a Means for Determining Adhesion

By FRANK MOSER
Pittsburgh Plate Glass Company, Glass Division, Research Laboratories, Creighton, Pennsylvania

● WETTING[1] GIVES A MORE quantitative knowledge of glass surfaces and provides a means for predicting adhesiveness between materials. Solids having chemical and physical properties similar to those of glass have the same range of contact angles and usually will adhere, while dissimilar materials give divergent contact angles and lack adhesion. Therefore, wetting indicates the materials that are suitable for bonding respective surfaces to glass.

An examination of resinous films using contact angle measurements in air-water systems was made for classifying materials with respect to polarity and compatibility of resins for formulating adhesive combinations. Often, a special preparation of the glass surface is required to obtain adhesion between dissimilar surfaces and contact angle measurements give the polarity difference which must be modified to establish adhesion between glass and the dissimilar solids. The dissimilarity of the surfaces is adjusted by the application of a coating or a primer to one of the bonding adherents. These techniques depend upon the presence of polyfunctional molecules to orient and give the coated surface the same range of polarity. An illustration of surface preparation for bonding is the adhesion of glass to a cast phenolic with a polyvinyl butyral. The contact angle measurements show that glass has a zero angle of contact, and the phenolic has a 43 degree angle. In this case the Vinal and glass are polar and readily adhere, whereas the dissimilarity occurs between the Vinal and the non-polar phenol surface. Thus, a bifunctional adhesive is applied to the phenolic surface and the non-polar group attaches to the phenolic surface, leaving a polar group extending into space for attachment to the polar Vinal.

Contact angle measurements in air-water systems serve as a very convenient means of predicting adhesion and may be used to formulate adhesives for respective solids. This study was initiated to group the surface properties of the solids, as adhesive materials.

Experimental

Surface studies of adherents, cast resins and coated resinous films were made, using contact angle measurements in air-water systems for classifying the materials. Ranges were arbitrarily set and were as follows: 0 to 20 degrees, polar; 21 to 45 degrees, slightly non-polar; 46 to 65 degrees, moderately non-polar; and 66 to 99 degrees, non-polar.

Films for the contact angle measurements were obtained either by casting a thin film of the adhesive material between chlorosilane covered glass plates, or by dip-coating glass or metal surfaces in dilute solutions of adhesives, using a Fisher-Payne dip-coater. After films were either air dry or heat cured they were examined for the contact angle, using a modified captive bubble apparatus[2] as shown in Figure 1. Delaminated surfaces of vinyl-phenol glass assemblies were examined for differences in contact angle from their initial angle to note the affinity of the adhesive for the respective surfaces.

Orientation was obtained by dip-coating the various adhesive formulations on a number of solids such as glass, cast phenol, calcite, rock salt, stainless steel, and copper. The coated surfaces were examined to note any

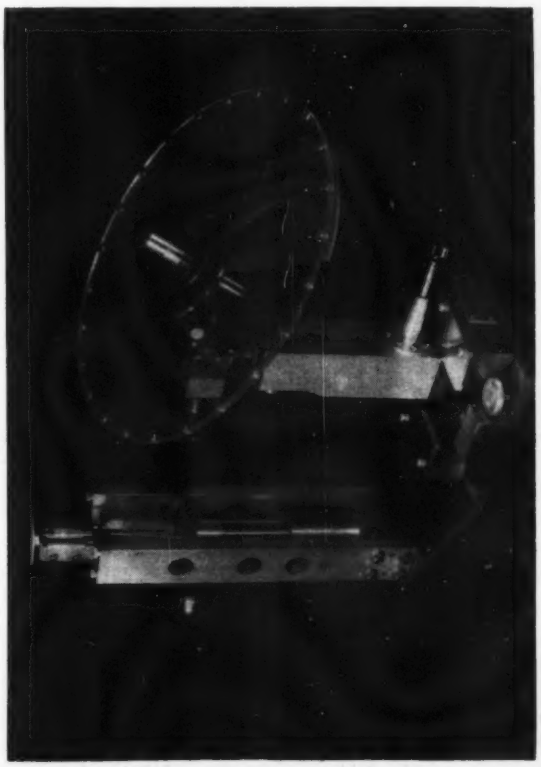


Fig. 1. Contact Angle Indicator.

(1) Fox, H. W., Hare, E. F., and Zisman, W. A. The Spreading of Liquids on Low Energy Surfaces VI Branched Chain Monolayers, Aromatic Surfaces, and Thin Liquid Films. J. Coll. Sci. 8:194:203, 1953.

(2) Kellogg, H. H. The Use of Contact Angles for the Study of Adsorption on Glass Surfaces. Glass Science Bulletin 2:58-96, 1945.

difference in polarity of the film surface which may have been caused by orientation of the molecule by the various solid structures. A postulation that similarity is essential for adhesion is indicated by the polyfunctional molecules tending to align their polar functional group toward the polar surface, leaving the non-polar portion extending into space. Such molecular adjustment is readily detected by contact angle measurement.

Orientation may be influenced by the choice of solvent for the resin molecule. Usually several solvent combinations may be used to dissolve the formulation. During the volatilization, the molecular alignment is dependent upon the character of the solvent. For example if toluene is the major one, the non-polar functional groups will be drawn to the surface of the film, while with a polar solvent, as a ketone, the polar portion extends into space. Such phenomena may be verified by contact angle measurements of the air dry coatings. Correlations were attempted between polarity of resin and the surface, while adhesion was measured by the cross-lap tensile method[3] according to ASTM, D1344-54T.

Experimental Results

Contact angles of glass surfaces are affected by numerous conditions. Usually absorbed gases and water vapor are present. Therefore, cleaning and other surface preparations are necessary before bonding with adhesives. Surface conditions of the adherents influence adhesion and often an improvement is obtained by a specific surface treatment. Wetting techniques are useful for determining the surface condition and to note any changes due to the treatment.

Clean glass surfaces give a zero angle of contact in an air-water system. Any increase in contact angle indicates that a change in the surface of the glass has occurred. The chemical composition of various glasses was checked to note any correlation between wetting and chemical composition of the glass. The results are shown in Table I and indicate that glass is a polar material with low angles of contact. As the major constituent of most glasses is SiO_2, the compositions appear to have similarity and therefore most all glasses are the wetting type. The commercial and experimental glasses listed in Table II show very little difference in wetting as most compositions are in the wetting range, from 0-20 degrees, while lead glass appears to be slightly non-polar with approximately a 35 degree angle. The high silicon content glasses, as Vycor and Pyrex give fairly good wetting, having values between 10 and 20 degrees. Likewise, quartz, pure SiO_2, has a contact angle of 10 degrees or lower. Other commercial and experimental glasses having various amounts of the oxides of silicon, sodium, aluminum, and calcium are the wetting type, having contact angles in the range from 10 to 20 degrees. Only the compositions having appreciable amounts either of barium, phosphorus, strontium, zinc or boron had contact angles from 20 to 25 degrees. Therefore, most glass surfaces are polar and surface modification of the other adherents may be necessary for attaching glass to materials of different polarity with a polar adhesive.

Cleaning and coating methods are the usual procedure for modifying surfaces. The effectiveness of various treatments on glass is given in Table II by comparing the contact angle measurement of the treated glass surface with the initial surface. Fire polishing and chromic acid cleaning are common cleaning procedures for glass. Both of these treatments give a clean surface as is indicated by the zero angle of contact. The adhesion se-

(3) ASTM Standard on Adhesives. September, 1954, page 160. Tensile Properties of Adhesives D 1344-54T.

Table I—Glass Composition and Wetting

Basic Ingredients	Type of Glass	Contact Angle Degrees
SiO_2 72%, Na_2O 13.7%, CaO 11.5%, MgO 2.5%, Al_2O_3 0.3%	Soda-Lime	0
SiO_2 29%, BaO 8.4%, PbO 62%, Sb_2O_3 0.6%	Lead	35-37
P_2O_5 67.51%, Al_2O_3 13.49%, CaO 6.90%, B_2O_3 5.05%, SiO_2 5.02%, Fe_2O_3 2.03%	Phosphate	18-20
SiO_2 61.3%, Na_2O 8.8%, B_2O_3 13.3%, ZnO 12.5%, Al_2O_3 2.2%, Na_2SO_4 0.7%, NaCl 0.7%, As_2O_3 0.5%	Zn Boro-Silicate	18-20
SiO_2 80.6%, B_2O_3 11.9%, Al_2O_3 2.0%, Na_2O 4.4%, (Ca as Mg) 1.1%	Boro-Silicate (Pyrex)	10-12
SiO_2 96%, B_2O_3 3.6%, Al_2O_3 0.4%	Vycor	10-12
SiO_2 71.42%, Na_2O 13.78%, CaO 12.9%, Na_2SO_4 0.85%, NaCl 0.85%	Solex	22-24
SiO_2 71.66%, Na_2O 13.14%, CaO 11.8%, MgO 2.52%, Al_2O_3 0.15%, Na_2SO_4 0.62%, NaCl 10.09%	Iron Free Plate	20-22
SiO_2	Quartz	7-10
SiO_2 59.13%, Na_2O 15.45%, SrO 25.42%	Strontium	17-20
SiO_2 39.0%, K_2O 15.5%, BaO 45.5%	High Barium	20-22

Table II—Wettability of Glass as Affected by Surface Preparation and Adhesion

Treatment	Air-Water System Contact Angle (Degree)	Bond Strength (psi) Copolymer Vinylite Room Temp.	Copolymer Vinylite After H_2O	With Epon Adhesives Room Temp.	With Epon Adhesives After H_2O
Fire Polished	0	1100	600	1100	600
Chromic Acid	0	1900	1400	1000	500
Trichlorosilane	90-95	—No Adhesion—		—No Adhesion—	
Organo-Silicate Primer	41-43	1100	1000	400	300
$AlCl_3$	42-44	2100	1000	1200	800
$SnCl_2$	28-30	1900	900	1200	800
Molybdic Acid	43-44	1300	1000	800	800

Table III—Contact Angles of Solids Coated with Resinous Films in Air-Water Systems

Solids / Film	Glass (Degrees)	Calcite (Degrees)	Cast Phenol (Degrees)	Copper (Degrees)	Stainless Steel (Degrees)	Cast Sheet of Respective Resin (Degrees)
None	0	0	43-45	22-24	20-22	....
Vinylite AYAF	44-46	40-43	41-43	38-40	36-37	40-42
Vinylite VMCH	60-63	56-59	57-59	59-60	60-63	47-50
Vinylite XYHL	30-32	40-42	45-48	12-15	35-38	28-30
Durez 12987	22-23	32-35	40-43	14-17	19-23	18-20
Durez 12687	48-50	41-44	40-41	38-41	35-37	35-37
Durez 550	60-63	61-63	61-63	54-55	61-63	58-60
Varicum 9837	38-40	28-30	30-32	38-40	35-38	30-32
Bakelite BR-9432	63-65	63-65	72-74	28-30	65-67	35-38
Bakelite BV-1112	43-44	28-30	45-47	28-31	41-43	....
Cellulose Acetate	38-40	33-36	43-47	34-37	37-39	42-43
Pliolite S-5	77-79	66-68	78-80	46-48	....	51-52
Pliolite S-50	33-35	56-59	78-80	40-42	56-59	37-40
Parlon 125	69-71	69-71	74-76	28-30	14-18	....
Hycar 1032X1	43-45	46-49	42-44	38-41	38-40	35-36
Polyblend	55-57	49-51	44-47	51-53	55-57	54-56
Polystyrene	80-82	78-80	80-82	51-53	68-70	77-80
Neoprene GN.A	33-34	26-28	....	18-21	35-33	34-36

Table IV—Contact Angle of Polish Plate Glass Coated with Adhesive Films in Air-Water Systems

Adhesive Film	Contact Angles (Degrees) Glass	Cast Phenol	Calcite	Copper	Stainless Steel
Amine Catalyzed Epoxy	18-21	26-28	23-25	15-18	16-18
Heat Cured Epoxy	48-51	....	....	32-34	52-54
Phenolic-Butyral	55-58	53-55	....	....	52-54
Hycar-Vinsol	28-30	24-27	24-27	15-18	15-16
Silicate-Phenolic Primer	40-42	18-20	43-45	42-43	42-44
Vinylite 28-18	15-18	15-17	16-17	18-20	14-15
Hycar-Vinylite	60-62	61-63	64-65	60-61	61-63
Tung Oil Modified Phenol-Butyral	43-45	44-45	44-46	41-43	40-42

curing on these polar surfaces was 1900 psi for a polar Vinylite adhesive, while 1100 psi for the slightly less polar epoxy. The volatilization of trichlorosilane vapors on a glass produces a very hydrophobic surface giving a 90 to 95 degree contact angle. Consequently, no adhesion with organic adhesives. Other surface preparations used on glass surfaces to enhance adhesion or to improve water resistance were to dip-coat either in solutions of aluminum chloride, stannous chloride, or molybdic acid. This changed the glass to a slightly non-polar surface ranging in contact angles from 30 to 44 degrees. The treatments gave good adhesion for both the Vinylite and the epoxy adhesives with bond failure occurring in the glass surface. The molybdic acid and $AlCl_3$ treated glass appears to have improved the water resistance for the epoxy adhesives.

The organo-silicate type primer[4] which has been very effective for bonding glass and metal surfaces with modified phenolic adhesives was not suitable for the Vinylite and epoxy adhesives. No improvement in strength was obtained on the Vinylite 28-18 adhesive, while the L-1372 gave much lower tensile strengths with the primer than on a clean glass surface. This was anticipated as the primer-glass surface was slightly non-polar with a 44 degree contact angle; while films of the Vinylite and epoxy adhesives gave 15 to 25 degree angles.

The alignment of the adhesive molecule on solid surfaces is shown in Table III for a number of polymeric materials. These solids varied in chemical composition, but the surface properties of glass, calcite and the metals are similar, giving contact angles from zero to 20 degrees. The cast phenolic was slightly non-polar with a 43° contact angle. Theoretically, an alignment of the bifunctional molecule should occur when contacting a surface, but inasmuch as the coated solids were quite polar no decided orientation was found. The data in Table III are a measure of the polymer's polarity on various solids and serve as a guide for selecting adhesive materials. Vinylite AYAF is moderately non-polar and therefore does not give high strength with glass, whereas Vinylite XYHL is more polar and will give fair adhesion to glass and metal. However, if polyvinyl butyral is plasticized with dibutyl phthalate the contact angle is reduced to 15 to 20 degrees. This polar combination gives excellent adhesion to glass.

Likewise Hycar 1032 is moderately non-polar with a 35 degree contact angle. Thus, when Hycar 1032 and Durez 12987 are compounded, a good adhesive is obtained for bonding Buna N rubber to glass. However, if Durez 12687 resin is mixed with the Hycar 1032, the combination is more non-polar and gives little adhesion between the Buna N and glass surfaces.

Further illustrations may be found in these data, but the examples cited show that contact angle data may be used to guide adhesive formulations. A number of adhesive mixtures are shown in Table IV which includes some commercial preparations as well as some laboratory formulations designed from contact angle measurements.

Orientation effects are more evident since more func-

(*Continued on page 228*)

(4) Moser, F. Some Fundamentals of Glass Adhesion. ASTM Bulletin, No. 150, pages 51-55, 1948.

Recent Translations of Russian Papers of Interest to the Glass Industry

Withdrawal of Glass Sheet Without a Debiteuse

Improvements in the above process, as adopted in Lvov Glass Factory, are described by I. D. Tykachinskii and I. O. Tomashevich in *Steklo i Keramika* (*Glass and Ceramics*) vol. **11,** No. 5, p. 7 (1954).

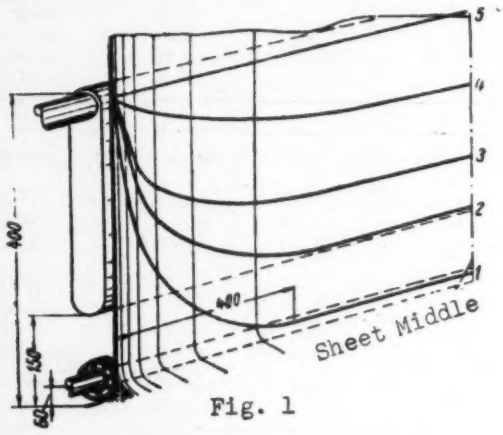


Fig. 1

An important difficulty of the process is caused by the temperature difference between the middle part of the sheet and its edges. When the sheet is pulled up, it stretches. The middle, which is warmer, stretches more than the colder edges. In consequence, each point on the edge moves up at a greater speed than a point in the middle, until the whole width of the sheet is solid; above this line the rate of ascent is, naturally, equal for all points of the sheet. This is illustrated in Fig. 1. A straight mark across the sheet surface, normal to the direction of withdrawal, after a time looks like line 1 on Fig. 1. The colder the glass, the less the curvature of the line obtained (see 2, 3, and 4 in Fig. 1). Finally, at line 5, the sheet is nearly solid and moves at a uniform velocity across its whole width. All numerical data in the Fig. are in mm.

Fig. 2 shows a cross-section of the sheet. The sheet thickness decreases along 60-100 cm. above the surface of the glass melt; above this height, the sheet is solid and its thickness constant.

Because the sheet stretches, its width tends to contract. To prevent this contraction, "edge-forming plates" were placed in the melt surface, i.e. above the submerged "float". A horizontal (above) and a vertical (below) view of such an arrangement are shown in Fig. 3. The edges of the sheet remained in the recesses of the "edge-forming plates" because glass melt wetted the refractory material of these plates.

This device caused new difficulties. The friction between glass and the refractories of the plates was great compared with the resistance experienced by the glass rising from a free surface of glass melt; thus, the difference between the middle and the edges was accentuated, it became more difficult to withdraw a defectless sheet, more of the edge had to be cut away, devitrification due to contact with refractories appeared, and so on.

Variations in the shape of the "edge-forming plates" and similar half-measures (described in the original paper) did not help enough, and finally the idea of "edge-forming plates" was abandoned.

The present arrangement is shown in Fig. 4. All numerical data are in mm. The submerged float, illustrated also in Fig. 5, is the only refractory unit in contact with glass melt, and the whole width of the sheet originates from the free surface of the melt. The rollers indicated in Fig. 4 apparently are short cylinders which are in

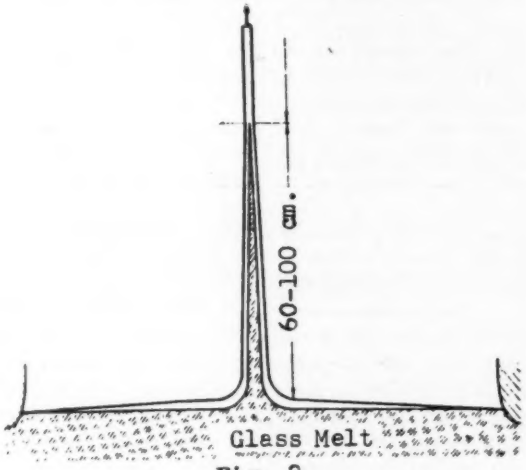


Fig. 2

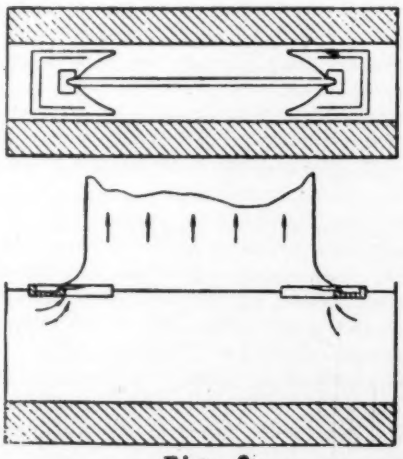


Fig. 3

contact with the edges only. They rotate at a speed which is different from the speed of withdrawal; experiments proved that if the linear velocity of the rollers is 0.3 that of the sheet, best results are obtained.

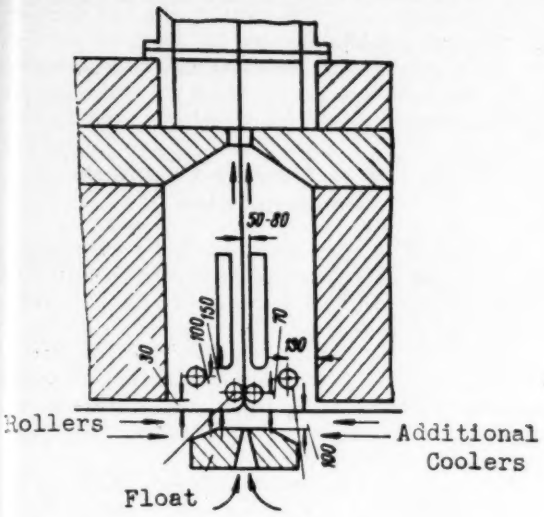


Fig. 4

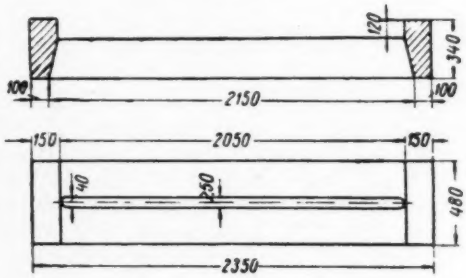


Fig. 5

Before the introduction of the above improvements the usable width of the sheet was 1.2 meter at the total width of 1.7 meter and the rate of withdrawal of a sheet (2.8 mm thick) was about 45 meters/hour. With the arrangement of Fig. 4, at least 1.5 meter of the 1.7 meter width was utilized, and the rate of withdrawal rose to 85 meters/hour.

Grinding Wheel of an Acrylic Plastic

A. S. Totesh and E. V. Gurkovskii report in *Steklo i Keramika* (*Glass and Ceramics*) vol. **11,** No. 5, p. 12 (1954), on a polymethyl methacrylate grinding disk for the polishing of glass. They found that the speed and the pressure of the acrylic plastic disk did not influence the quality of the polished surface. Apparently, when work-

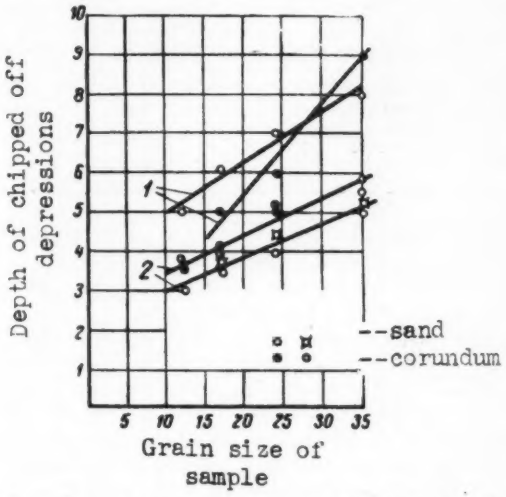


Fig. 1 (1) cast iron grinding disk
(2) plastic grinding disk

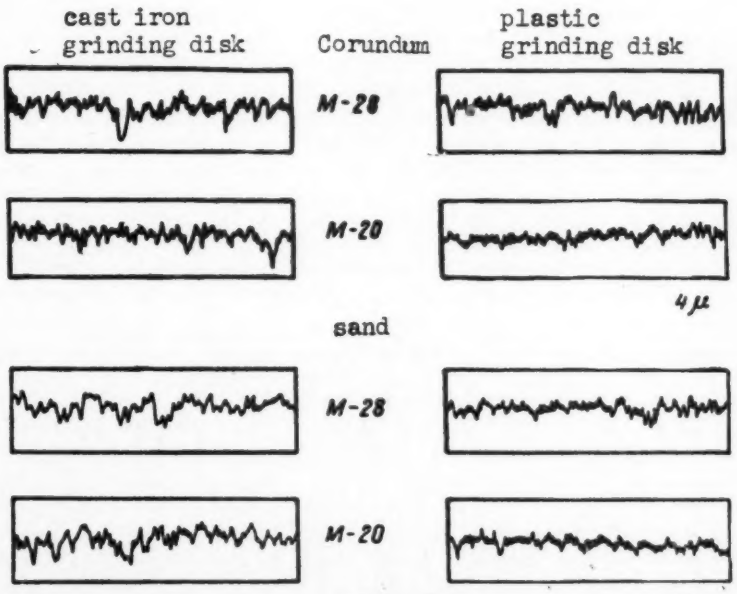


Fig. 2

ing with a plastic as well as with a cast-iron disk, the forces which depend on the pressure and on the velocity of rotation of the grinding disk are higher than those necessary to crush the grains of abrasive. But the forces which can be imparted to the glass cannot be higher than those needed for crushing the abrasive grain; that is the reason why the depth of chipping off of the ground surface is independent of the pressure and velocity of the grinding disk but is determined by the crushing strength of the abrasive grain.

The following data give the ratio R of the amount of glass abraded to the abrasion of the grinding disk at the same time. The pressure of the grinding disk was 100 gram/cm² at 430 revolutions per minute.

Grinding disk material	Amount of glass abraded grams/hour	R=Abrasion of glass to abrasion of disk
Polymethyl methacrylate	1.80	3.2
Polyvinyl chloride	2.34	0.8
Urea formaldehyde resin	1.80	0.2
Urea melamine resin	1.08	0.2
Cast iron	6.00	15.0

As can be seen from the Table, for all the plastic disk materials the amount of glass abraded was very similar but ratio R varied greatly. The least abrasion was suffered by polymethyl methacrylate.

When a polymethyl methacrylate grinding disk was used, a much finer and more uniform polished surface was obtained than when using a cast iron grinding disk.

Fig. 1 shows how the grain size of the abrasive affects the depth of the chipped off depressions when a plastic grinding disk or a cast iron grinding disk is used, and Fig. 2 shows profilograms of the glass surfaces for both grinding disks, for two grain sizes of each sand and corundum M20 and M28; (for the meaning of these notations, see the abstract of the paper "Grain Size of Abrasives used in the Grinding of Glass.")

The depth of the damaged layer when sand was used was by 1-2 microns smaller than when corundum was used, which can be explained by the smaller force necessary to crush the grains of sand than the grains of corundum. Thus the use of sand is preferable with the plastic grinding disk and though sand is usually less effective, this can be compensated in this case by increating the pressure of the plastic grinding disk without thereby harming the quality of the ground surface.

As can be seen from the profilogram the depth produced by the plastic grinding disk is smaller by about 30 per cent than those made by the cast iron grinding disk, when using either sand or corundum.

The plastic grinding disk speeds up the time necessary for the final polishing of glass by about 25 per cent, but as the grinding with the plastic disk takes somewhat longer, the total time gain is 10-15 per cent compared to the standard method using a cast iron grinding disk.

Grain Size of Abrasives Used in the Grinding of Glass

An abrasive is marked and numbered according to the grain size of the material (corundum, sand) used. Yu. A. Brodskii and Z. M. Zinkova (as reported in *Steklo i Keramika* (*Glass and Ceramics*) vol. **11,** No. 8, p. 10 (1954)) find that besides grains of average size all abrasives contain an unavoidable admixture of larger and smaller grains, and the larger grain fraction is very important for the efficiency of the abrasive powder when used in the grinding of glass.

They use electrocorundum powders M-10, M-14, M-20, and M-28, as well as mixtures of these powders to grind polished glass surfaces.

The composition of the glass is SiO_2 71.17 per cent, $Al_2O_3 + TiO_2$ 1.7 per cent, Fe_2O_3 0.17 per cent, CaO 8.23 per cent, MgO 1.87 per cent, SO_3 0.57 per cent, Na_2O 15.6 per cent.

Table 1 gives the percentage of grains having diameters within the range shown in the column headings. All the diameters are in microns. Those of original powders (i.e. M-10, M-14, M-20, and M-28) are determined microscopically, and those of the mixtures are calculated. Further in Table 1 W_g is the weight in grams of the glass abraded in 20 min. The quality of the glass surface, as registered by a profilogram indicating the average (H_a) and (H_m) the maximum height of the hills is shown in the two last columns.

The table shows that a small addition of the next grain size of abrasive gives a larger increase in the bigger grain size fraction (e.g., 0 to 2.57 for No. 1 and 4) than the comparative decrease in the basic fraction (from 87.7 for No. 1 to 73.8 for No. 4) and the abrasion increases from 0.2494 to 0.3325 g.

This indicates that the increased abrasion is due to the higher content of large size grains in the abrasive powder.

(*Continued on page* 226)

TABLE 1

No.	Abrasive powder	Per cent of grains between 48-28 microns	28-20 microns	20-14 microns	14-10 microns	10-7 microns	7-3 microns	W_g	H_a	H_m
1	100%M-10				10.3	87.7	2.0	0.2494	0.43	3.05
2	97%M-10 + 3%M-14			0.50	12.5	85.0	1.95	0.2730	0.48	3.4
3	90%M-10 + 10%M-14			1.69	17.9	78.5	1.85	0.3075	0.52	3.36
4	85%M-10 + 15%M-14			2.57	21.8	73.8	1.76	0.3325	0.54	3.38
5	100%M-14			15.10	78.0	6.1	0.60	0.3826	0.60	3.56
6	97%M-10 + 3%M-20		0.50	2.55	10.2	84.8	1.94	0.2963	0.50	3.61
7	90%M-10 + 10%M-20		1.73	8.74	10.1	77.6	1.77	0.3875	0.65	3.60
8	100%M-20		14.80	74.70	8.6	1.7	..	0.4730	0.77	4.88
9	97%M-10 + 3%M-28	0.40	2.54	0.02	10.0	84.9	1.93	0.3452	0.65	3.31
10	90%M-10 + 10%M-28	1.36	8.73	0.77	9.3	78.0	1.78	0.5593	0.99	5.35
11	100%M-28	12.14	79.40	7.0	1.1	..	..	0.5748	1.03	6.56

Inventions and Inventors

Annealing and Tempering

Annealing Lehr. Fig. 1. Patent No. 2,725,680. Filed July 17, 1953. Issued December 6, 1955. Four sheets of drawings. Assigned to Pittsburgh Corning Corporation by A. H. Baker.

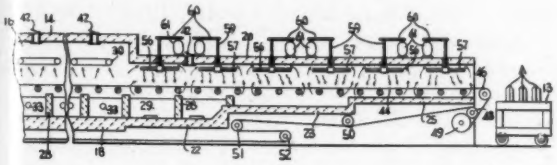


Fig. 1

The invention is specifically directed to the annealing of cellular glass, which requires rather specific and defined zones of temperature. The novel features of the lehrs are shown in Fig. 1. Within the heated zones of the lehr, uniform temperature is maintained by introducing heated gases from conduits 33, below the conveyor 44. Due to individually controlled heating means 41 (not shown) associated with each inlet conduit 33, substantial horizontal uniformity of temperature is maintained between each opposing inlet conduits 33 and adjacent outlet conduit 30. Likewise, walls 28 and 29 define zones of heat about each inlet conduit 33. Hence, having outlet conduit 30 above each inlet conduit 33, definite transverse temperature zones are maintained longitudinally of the lehr, without detrimental mingling of the two differently heated streams of gases flowing between the adjacent vertically disposed pairs of conduits 30 and 33. As the slabs move beneath fans 56 and 57, the slabs are being cooled, and the cooling air currents move downwardly from the fans between the slabs and through belt 44, to impinge upon the bottom of the lehr and return to the top of the lehr as previously stated.

Slow movement of the slabs through the lehr permits the obtaining of uniform temperatures throughout the cross-sectional area of the slabs.

There were ten claims and the following references were cited in this patent: 620,139, Hysore, Feb. 28, 1899; and 1,979,216, Morton et al., Oct. 30, 1934.

Bottle Decorating Machine. Patent No. 2,721,516. Filed August 18, 1951. Issued October 25, 1955. 18 sheets of drawings; none reproduced. Assigned to Solar Engineering & Equipment Company, by G. H. Campbell and R. G. Martin and Bradford Martin.

This invention relates to decorating machines of the type designed to apply color compositions to articles, by means of a screen process in which a screen membrane is utilized that is pervious in design areas and impervious in non-design areas. The color compositions used are of two general types. The so-called "cold color" mixtures which dry at room tempertaure, and those in which the pigmented materials are carried in thermo-responsive vehicles which, when heated above room temperature, are of thin paste-like consistency, ideally suited for screen stencil work, but which freeze or solidify immediately upon being applied to the relatively cooler surfaces of articles which are at room temperature. A fully automatic machine is provided in which a single color, or a number of colors in accurate register may be applied to bottles during one pass through the machine, so that when they emerge they are completely decorated and ready for firing.

It is capable of operating efficiently at very high speed, maintaining a production rate as high as one article per second, but which also may be operated just as efficiently at lower speeds. The discharge rate can be geared to existing lehr facilities in which decorated articles are fired.

The body and neck portions of bottles can also be decorated at the same time, even though these two portions are of different diameters and require screens moving at different rates. Adjustable screen drive mechanism is provided so that each screen at a particular station can operate upon bottles varying in size and shape over a considerable range.

There were 16 claims and the following references cited in this patent: 1,990,498, Nordquist, Feb. 12, 1935; 2,193,840, Oberhoffken, Mar. 19, 1940, and 2,231,535, Jackson et al., Feb. 11, 1941.

Annealing Glass Sheets in Continuous Process. Patent No. 2,725,679. Filed March 27, 1953. Issued December 6, 1955. Two sheets drawings; none reproduced. Assigned Compagnies Reunies des Glaces & Verres Speciaux du Nord de la France by Bernard Long.

The primary object of this invention is to provide a process of industrial annealing, which permits the rapid, sure and simple production of drawn or cast sheets. A good distribution of permanent internal strains, and the low intensity of these strains, guarantees results superior to those given by sheets of the same thickness annealed by other process now actually in use.

The process comprises three successive operations: (1) After the sheet has been formed in the usual manner, it is moved through an enclosure in which the temperature of the sheet may be equalized and from which it emerges having an equal temperature at all points. (2) Immediately after the operation of equalizing its temperature, the sheet is introduced into another enclosure in which it is cooled evenly, solely by radiation, under such conditions that the effect of convection is rendered absolutely negligible. (3) As it leaves the enclosure for cooling by radiation, the sheet moves forward and undergoes a uniform convective cooling by means of air currents, until its temperature is sufficiently low for it to be cut. All irregular cooling of the surfaces by reason of the capricious nature of natural convection is thus avoided and, as a consequence, so are those cracks and fractures due to transitory strains.

There were 5 claims and 12 references cited.

Feeding and Forming

Glass Feeder Plunger. Patent No. 2,725,681. Filed April 30, 1954. Issued December 6, 1955. One sheet of drawings; none reproduced. Assigned Emhart Manufacturing Company by F. J. Wythe.

This invention relates to improvements in cam controlled glass feeder plunger operating mechanisms. This is accomplished by providing a hydraulic servo motor system operatively connected with the vertically movable plunger assembly and controlled by means of a valve interposed in the lever and linkage system, between the cam and plunger supporting assembly, so that the hydraulic servo motor will take over at least most of the power demands which otherwise would be wholly imposed on the cam. The motor assembly raises and lowers the plunger with strokes having characteristics determined by the co-action of the cam with the lever and linkage system.

Practically all the power requirements for the feeder plunger operation are thus supplied by the hydraulic power system, the cam and the elements of the lever-and-linkage system between the cam and the plunger assembly. They serve mainly for control of the hydraulic power system, so as to control the timing and the characteristics of the feeder plunger strokes.

There were 9 claims and the following references cited in this patent: 2,246,461, Cannon, June 17, 1941.

Hollow Glass Vials. Patent No. 2,725,683. Filed January 26, 1953. Issued December 6, 1955. One sheet of drawings; none reproduced. Assigned to the Compule Corporation by M. L. Lockhart.

The present invention relates to a method of blowing hollow glass vials in mold cavities.

A method is provided for blowing hollow glass vials in mold cavities, with formation of waist constrictions, while assuring that the natural or inherent tendency of molten glass to flow in a curve and to convex over an obstruction will be accommodated to the exterior of the vials and to permit relatively cylindrical rather than hyperbolic surfaces to be formed in the constrictions, by the flowing of molten glass attendant upon the blowing.

The desired elongated cylindrical internal seating surface is thus uniquely formed, solely by a blowing operation, without necessitating employment of an internal or core die or plunger-forming element to press the molten glass at the waist constriction to the final shape.

Substantially flat, rather than convexed, internal plug or cork seating surfaces are thus formed in waist constrictions of blown glass vials.

There was one claim and the following references were cited in this patent: Re. 23,564, Hobson, Oct. 14, 1952; 299,318, Atterbury, May 24, 1886; 344,500, Schrader, June 29, 1886; 424,524, Washington, Apr. 1, 1890; and 533,623, Ulfig, Feb. 5, 1895.

Glass Wool and Fiber

Improved Water Repellency of Mineral Wool. Patent No. 2,714,276. Filed December 29, 1950. Issued August 2, 1955. Assigned to American Cyanamid Company by Chester G. Landes.

This invention relates to the treatment of mineral wool and more particularly, to a process of imparting water resistance to mineral wool. The wool is impregnated with 0.005 per cent to 0.05 per cent by weight based on the dry weight of the mineral wool of a water-soluble condensation product of epichlorohydrin and a fatty amine. The latter should contain from 16 to 18 carbon atoms and possess no more than 50 per cent unsaturation. The epichlorohydrin is present in an amount of from 1.2 to 2.5 mols per mol of fatty amine. The impregnated wool is dried for one hour at 260°F., in an oven in order to water insolubilize the condensation product. The water resistance of the properly prepared wool is said to be greatly improved and at the same time other properties are not disadvantageously affected.

There were 6 claims and 11 references cited in this patent: 1,977,253, Stallmann, Oct. 16, 1934; 2,083,132, Williams et al., June 8, 1937; 2,107,284, Bone et al., Feb. 8, 1938; 2,136,928, Schlack, Nov. 15, 1938; 2,174,762, Schuette et al., Oct. 3, 1939; 2,189,840, Simison, Feb. 13, 1940; 2,356,542, Sloan, Aug. 22, 1944; 2,468,086, Latham et al., Apr. 26, 1949; 2,479,480, Dudley, Aug. 16, 1949; 2,569,920, Buck, Oct. 2, 1951; and Silver et al.: *Modern Plastics*, November 1950, vol. 38, Issue 3, pages 113, 114, 116, 118, 120, 122.

Producing Fibers. Patent No. 2,717,416. Filed March 7, 1951. Issued September 13, 1955. Three sheets of drawings; none reproduced. Assigned to Owens-Corning Fiberglas Corporation by Ed Fletcher.

This invention relates to an improved method for producing fibers from thermofusible fiber-forming materials such as glass, rock or slag.

A stream of molten material is introduced into the very core of the blast where the velocity of the blast is capable of converting the material to fiber form with the highest degree of efficiency. At the same time the molten material is introduced into the blast in such a way that there is an anchor or resistance to movement created. The material thus subjected to the force of the blast is pulled or drawn out against a relatively, stationary part of the stream. An actual stretching out of the molten stream occurs much in the same way that a strip of rubber is stretched out if one end is held while the other is moved away from the stationary end.

This is accomplished by an apparatus which modifies the normal patr of travel of an air layer induced by movement of a blast of gases, and of configurating the discharge opening in the burner in a manner to cause the blast of gases to fold inwardly upon the fiber attenuating zone of the blast. The fibers are formed by attenuation or fiberization in the core or body of the blast. This arrangement provides for an efficient and continuous fiberization or fiber attenuating method in which fibers of a substantially uniform diameter may be continuously produced without the formation of slugs or pellets or other nonusable configurations.

There were 26 claims and 13 references cited in this patent.

Continuous Strands. Patent No. 2,719,352. Filed August 20, 1953. Issued October 4, 1955. Nine pages of drawings; none reproduced. Assigned to Owens-Corning Fiberglas Corp. by G. Slayter and W. W. Drummond.

This invention relates to a method for handling continuous strands. Where a continuous strand, filament or

similar elongated object is produced or made available at a high linear rate of speed it is difficult to package the strand or fabricate end products from the strand because of the impossibility of adequately handling the strand at its extremely high rate of production.

This invention includes in its principal object the provision of a continuous mechanical process for the doubling up of a continuous strand in loops, coils, or swirls and wherein at least one end of each loop is momentarily grasped and then released in timed sequence so that the strand is doubled up upon itself. Depending upon the timing and nature of the grasping and releasing, it may be directly made into a final product previousyl requiring intermediate winding and unwinding steps.

There were 17 claims and the following references were cited in this patent: 796,740, Linkmeyer, Aug. 8, 1905; 2,604,687, Broden, July 29, 1952; and 420,085, France, Nov. 14, 1910.

Glass Compositions

High-Index Glass Elements. Patent No. 2,726,161. Filed September 21, 1953. Issued December 6, 1955. No drawings. Assigned to Minnesota Mining & Mfg. Co. by W. R. Beck and N. W. Taylor.

This invention relates to transparent high-index glass elements, such as glass beads, fibers, flakes and thin plates, as new and useful articles of manufacture.

The following compositions have been found useful and have a refractive index of at least 2.1: (Tables below.)

Luminescent Material. Patent No. 2,719,128. Filed May 11, 1954. Issued September 27, 1955. One sheet of drawings; none reproduced. Assigned to Patent-Treuhand-Gesellschaft für Elektrische Glühlampen, by Georg Kressin (Germany).

The present invention relates to a luminescent material adapted to be excited by ultra-violet rays, X-rays, or cathode rays. This luminescent material is particularly suitable for electric discharge lamps such as low pressure mercury fluorescent tubes.

The method of manufacturing the luminescent materials comprises mainly the steps of mixing calcium and strontium compounds, namely the oxides or compounds which form the oxides upon heating, i.e., the carbonates, with silica and with lead and manganese compounds. Preferably the mixture consists of 0.95 mole of calcium: 0.05 mole of strontium: 1.1 moles of silica.

The formed mixture is then calcined. The heating is preferably carried out in an atmosphere of steam so as to prevent oxidation during heating. Preferably the heating is carried out at a temperature between 1100-1200°C.

It is preferred to alternately heat the mixture, e.g., at about 1100° C., then mill and sift the heated material, and then heat again three additional times at a temperature of about 1100-1200° C for 1½ hours, each heating period being followed by a milling and sifting step.

(*Continued on page* 224)

Table I

No.	Percentage composition by weight									Refractive Index
	TiO_2	Bi_2O_3	PbO	BaO	ZnO	B_2O_3	SiO_2	P_2O_5	GeO_2	
1	25.5	16.3	43.0	15.2	..	..	..	..	..	2.26
2	27.6	45.4	8.4	14.2	..	..	2.9	1.5	..	2.26
3	39.0	34.0	..	24.5	..	2.5	..	..	..	2.24
4	40.0	34.0	..	26.0	..	..	..	..	..	2.26
5	45.0	15.0	..	40.0	..	..	..	..	..	2.13
6	35.0	25.0	18.0	20.0	..	..	..	..	..	2.29
7	25.0	50.0	20.0	..	..	5.0	..	..	2.0	2.30
8	47.0	10.0	..	43.0	..	..	..	..	..	2.12
9	30.6	62.1	..	6.3	..	..	1.0	..	..	2.47
10	25.0	10.0	55.0	8.0	..	2.0	..	..	..	2.24
11	35.0	15.0	28.0	22.0	..	..	..	..	..	2.24
12	40.7	10.6	10.6	35.6	..	2.5	..	..	..	2.14
13	30.6	62.1	..	6.3	..	..	1.0	..	..	2.47
14	34.8	18.0	40.6	1.6	5.0	..	..	..	..	2.37
15	34.1	44.1	14.5	2.4	4.9	..	..	..	..	2.39
16	26.7	27.0	35.0	..	7.1	..	2.8	1.4	..	2.31
17	20.0	20.0	50.0	4.0	3.0	3.0	..	..	..	2.25
18	49.0	10.0	..	35.0	6.0	..	..	..	..	2.17
19	20.0	50.0	10.0	10.0	..	10.0	..	..	..	2.17
20	20.0	60.0	..	10.0	..	10.0	..	..	..	2.16
21	30.0	40.0	20.0	..	..	10.0	..	..	..	2.16
22	20.0	67.5	..	8.0	2.0	2.5	..	..	..	2.36

Table II

No.	Percentage composition by weight										Refractive Index
	TiO_2	Bi_2O_3	PbO	SrO	CaO	MgO	CdO	B_2O_3	SiO_2	P_2O_5	
23	41.6	30.4	..	..	..	..	28.0	..	..	..	2.32
24	25.6	26.1	33.7	..	..	..	10.6	..	2.7	1.3	2.33
25	27.7	28.0	36.4	..	..	3.6	..	..	2.9	1.4	2.30
26	26.1	26.6	34.4	8.8	..	..	..	..	2.8	1.3	2.30
27	27.2	27.7	35.9	..	4.9	..	..	..	2.9	1.4	2.26
28	25.0	10.0	45.0	..	..	..	15.0	2.5	2.5	..	2.27

There were six claims and the following reference was cited in this patent: 2,220,765, Hirose et al., Nov. 5, 1940.

Research Digest

Recent Developments in Bonded Zircon Refractories for the Glass Industry

The application of zircon and zirconium oxide bearing refractories in glass melting has been conceived within the past 25 years. Although zirconium oxide has very desirable properties, its application as a pure oxide refractory in glass melting has been limited by its high cost and thermal instability. Zircon, which is more stable in the commercial glass melting range and possesses some of the inert properties of zirconium oxide, is now available in unlimited quantities at relative low cost and, thus, is receiving more attention as a new refractory in the glass industry. A comprehensive review of this usage is given by Thomas and Knauft in the January 1956 issue of the *Bulletin of The American Ceramic Society*.

Prior to 1948, one manufacturer of dense, white opal glass jars and containers observed that bonded zircon refractories in the furnace superstructure were attacked by batch dust and vapor less than either silica, aluminum-silicate or high alumina refractories in the same furnace. These are 100 tons, plus regenerative continuous tanks, fired with natural gas. When constructed with fused cast zirconia-alumina side walls and throat, they have a potential life of two or more years, but they are usually shut down after 11 to 14 months for complete replacement of better grades of clay bottom blocks. After a preliminary trial of several bonded zircon side wall blocks, both the melter and refiner bottom of one opal glass tank was installed in 1948, using bonded grog-type zircon blocks 12 inches thick. When this furnace was shut down for economic reasons after 44 weeks of continuous service, it was found that the maximum erosion of the bonded zircon bottom was approximately ¾ inch in the melter, while there was no appreciable loss in the refiner. When this bottom was last inspected in December, 1953, the maximum loss in the melter was 2½ to 3 inches after 1633 operating days, two complete installations of fused cast blocks in side wall and throat, and at least four cycles of heating and cooling.

In 1950, an investigation was made of the possibilities of using thinner bonded zircon blocks and standard brick sizes, for paving over either used or new clay bottom blocks, in the interest of lower first cost and ease of installation. In one test a paving of 4½ x 9 x 18 inches bonded zircon brick was set over 8 inches of used clay flux in an opal glass tank. A section about 10 feet long was so installed, beginning at the dog house. This paving lost from ¼ to ⅜ inch after 308 days of service, compared to an additional loss of 3 to 3½ inches on the unpaved clay flux. The clay blocks, between the test panel and the bridge wall, were replaced with 8 inches of new clay block, paved with 12 x 6 x 3 inches zircon brick. The unit is still in service. To date several additional opal glass tanks have been installed with either 12 x 6 x 3 inches or 9 x 4½ x 3 inches zircon brick paved over clay bottom blocks. Results have been uniformly good with glass quality excellent. There has been no indication that premium grade, dense, fine grained zircon blocks, or tile are required, or are more economical for this service than standard bonded zircon blocks. Due to its low coefficient of thermal expansion, no provision for expansion is necessary with zircon brick and tight joints are obtained through use of zircon cement.

Bonded zircon refractories have also been used successfully as feeder channels, spouts, or orifice rings in contact with dense opal and special boro-silicate glasses. Manufacturers of boro-silicate, heat resisting glasses and glass textile fibers, have selected zircon glass contact refractories on the basis of longer furnace life and improved glass quality. In the glass fiber industry, for example, complete furnaces are built using fine grained, dense bonded zircon refractories below the glass line and standard zircon brick and shapes for the complete upper structure.

Bonded zircon refractories are not recommended as a substitute for either vacuum cast clay or fused cast blocks in the side walls of furnaces in which soda-lime container glasses are melted. However, the successful application of bonded zircon paving over clay bottoms in opal tanks, and the results obtained in laboratory tests, led to other trials of zircon brick paving in flint container and tableware furnaces. A test panel of 12 x 9 x 3 inches dry, pressed zircon brick was installed, 27 inches wide by 20 feet 6 inches, in the melter of a flint container furnace with 42 inches glass depth. The test panel was surrounded by two types of fused cast blocks 4 inches thick. All paving was installed over a 12 inch clay bottom which had run 48 weeks. All paving was found to be intact after a run of 52 weeks and was left in place for a second campaign.

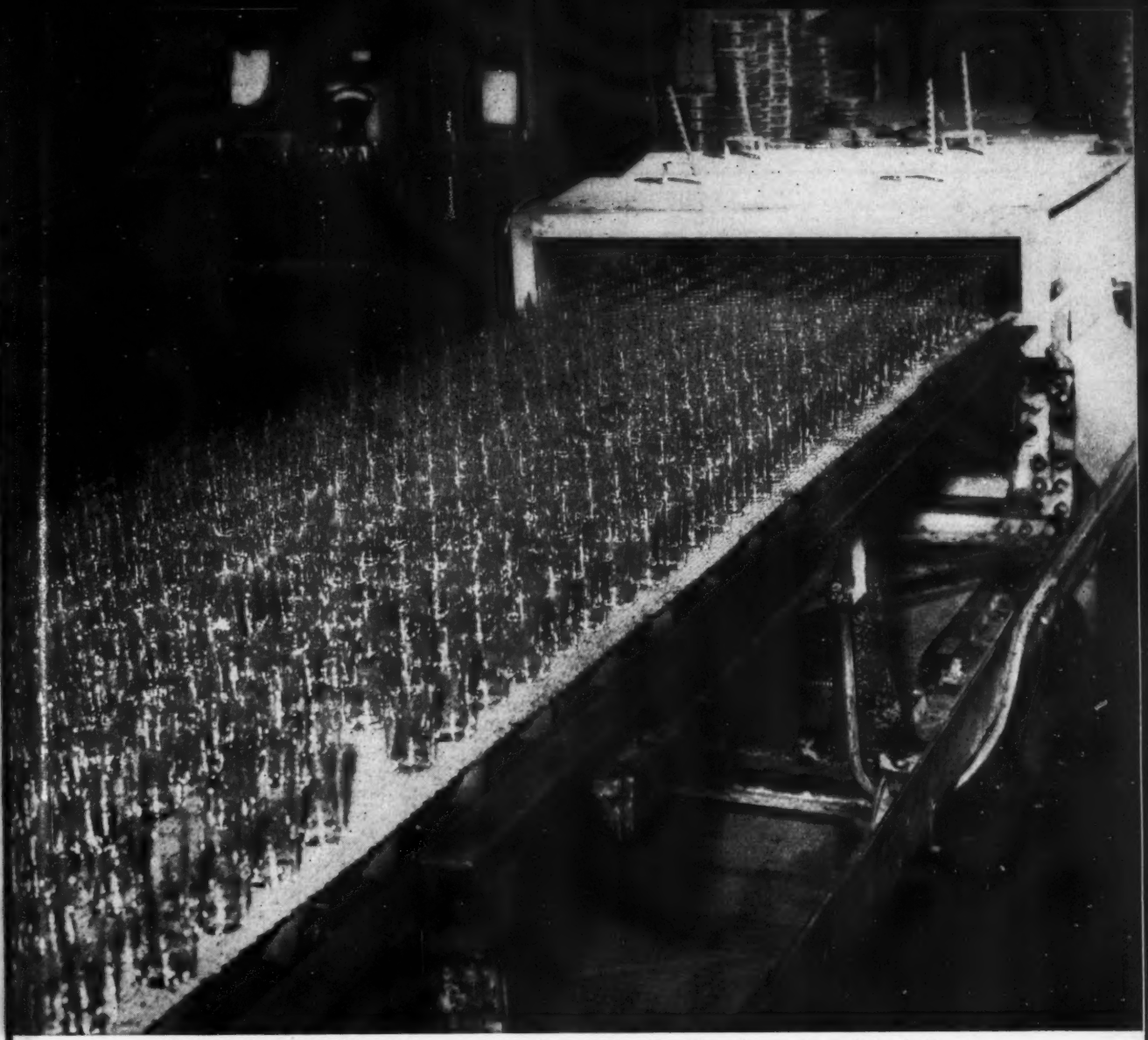
A section was cut from the zircon 12 x 9 x 3 inches brick to determine the extent of reaction at contact face. Glass penetration was approximately ¾ inches, but erosion and solution progressed very slowly. X-ray examination shows the alteration of zircon to zirconia at the interface, with silica and some ZrO_2 being taken into solution. This slow rate of attack is believed due to the relatively low temperature in this area of the tank, and the presence of a high specific gravity and viscous glass-containing some zirconia, which acts as a protective coating on the bonded zircon brick.

The life story of a bonded zircon paving in one rather small, shallow continuous tank used for production of flint glass containers and pressed ware was shown by the following data:

Square feet of meter area	220
Side wall height—net	27″
Total operating days	509
Net tons of glass melted	12,126
Net tons/100 square feet/day	10.4
Net tons/square feet of melter	50.1
Average temperature of melter	2,825° F.

After all remaining glass and original zircon paving

(*Continued on page* 237)



Wissco Belts carry Libbey glassware through annealing lehr. The glassware—and the belts—are subjected to elevated temperatures for approximately an hour. This is another example of how...

FAMOUS NAMES

ride on WISSCO BELTS

Libbey Glass Division of Owens-Illinois

Libbey is a name that's well known for glassware of top quality. For its annealing operation, which helps insure this quality, Libbey purchased four Wissco Belts of thin, flat construction with improved lehr edge. High heat is applied at the beginning of the operation, and then gradually diminished. The glassware emerges at the cool end of the lehr with stresses and strains equalized. Wissco Alloy Processing Belts are the choice of many famous names in industry—leaders in their fields. You, too, will find Wissco the most economical and efficient belt for every processing operation—for metals, ceramics, glass annealing and decorating.

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2769

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during January, 1956 was as follows: *Flat Glass:* A preliminary figure of 30,300 for January, 1956 indicates a decrease of 0.7 per cent from the adjusted 30,500 reported for December, 1955. *Glass and Glassware, Pressed and Blown:* A drop of 1.4 per cent is shown by the preliminary 78,400 figure of January, 1956 when compared with the 79,500 figure of December, 1955. *Glass Products Made of Purchased Glass:* The preliminary January, 1956 figure of 16,000 indicates a drop of 3 per cent from the previous month's 16,500 figure. Payrolls in the glass industry during January, 1956 were as follows: *Flat Glass:* An increase of 1.1 per cent is shown in the preliminary $15,878,109 when compared with December, 1955 adjusted $15,701,400. *Glass and Glassware, Pressed and Blown:* An increase of 0.1 per cent is shown in the preliminary $26,757,136 reported for January, 1956 when compared with the previous month's adjusted $26,723,130. *Glass Products Made of Purchased Glass:* A preliminary figure of $4,759,040 was reported for January, 1956. This is 5.9 per cent lower than the adjusted December, 1955 figure of $5,056,425.

GLASS CONTAINER SHIPMENTS

(All Figures in Gross)

Narrow Neck Containers

	February, 1956
Foods	993,000
Medicinal and Health Supplies	1,302,000
Chemical, Household and Industrial	713,000
Toiletries and Cosmetics	701,000
Beverage, Returnable	759,000
Beverage, Non-returnable	79,000
Beer, Returnable	149,000
Beer, Non-returnable	511,000
Liquor	720,000
Wine	365,000
Sub-total (Narrow)	6,292,000

Wide Mouth Containers

Food	*2,553,000
Medicinal and Health Supplies	398,000
Chemical, Household and Industrial	173,000
Toiletries and Cosmetics	239,000
Packer's Tumblers	110,000
Dairy Products	187,000
Sub-total (Wide)	3,660,000
Total Domestic	9,952,000
Export Shipments	220,000
TOTAL SHIPMENTS	10,172,000

* This figure includes Fruit Jars and Jelly Glasses.

GLASS CONTAINER PRODUCTION AND INVENTORY

(All Figures in Gross)

		Production February 1956	Stocks February 1956
Foods; Medicinal and Health Supplies; Chemicals, Household and Industrial: Toiletries and Cosmetics	Narrow Neck	4,100,000	4,972,000
	Wide Mouth	*3,752,000	*4,735,000
Beverage, Returnable		1,032,000	1,665,000
Beverage, Non-returnable		75,000	205,000
Beer, Returnable		208,000	371,000
Beer, Non-returnable		557,000	894,000
Liquor		710,000	1,015,000
Wine		356,000	522,000
Packer's Tumblers		118,000	159,000
Dairy Products		220,000	344,000
TOTAL		11,128,000	14,882,000

* This figure includes Fruit Jars and Jelly Glasses.

Glass container production based on figures released by the Bureau of Census rose 0.3 per cent during February, 1956 to reach 11,128,000 gross. This is an increase from the previous month's 11,099,000 gross. During February, 1955 production was 10,211,000 gross, or 9 per cent lower than the February, 1956 production. Glass container production for the first two months of 1956 has reached a preliminary total of 22,227,000 gross.

Shipments of glass containers during February, 1956 increased 3.7 per cent to reach 10,172,000 gross. This is an increase over the January, 1956 shipments which were 9,814,000 gross. Shipments during February, 1955 were 9,398,000 gross, or 7.6 per cent lower than February, 1956. The preliminary total shipments for 1956 is 19,986,000 gross which is 5 per cent ahead of the 19,043,000 gross shipped during the corresponding period in 1955.

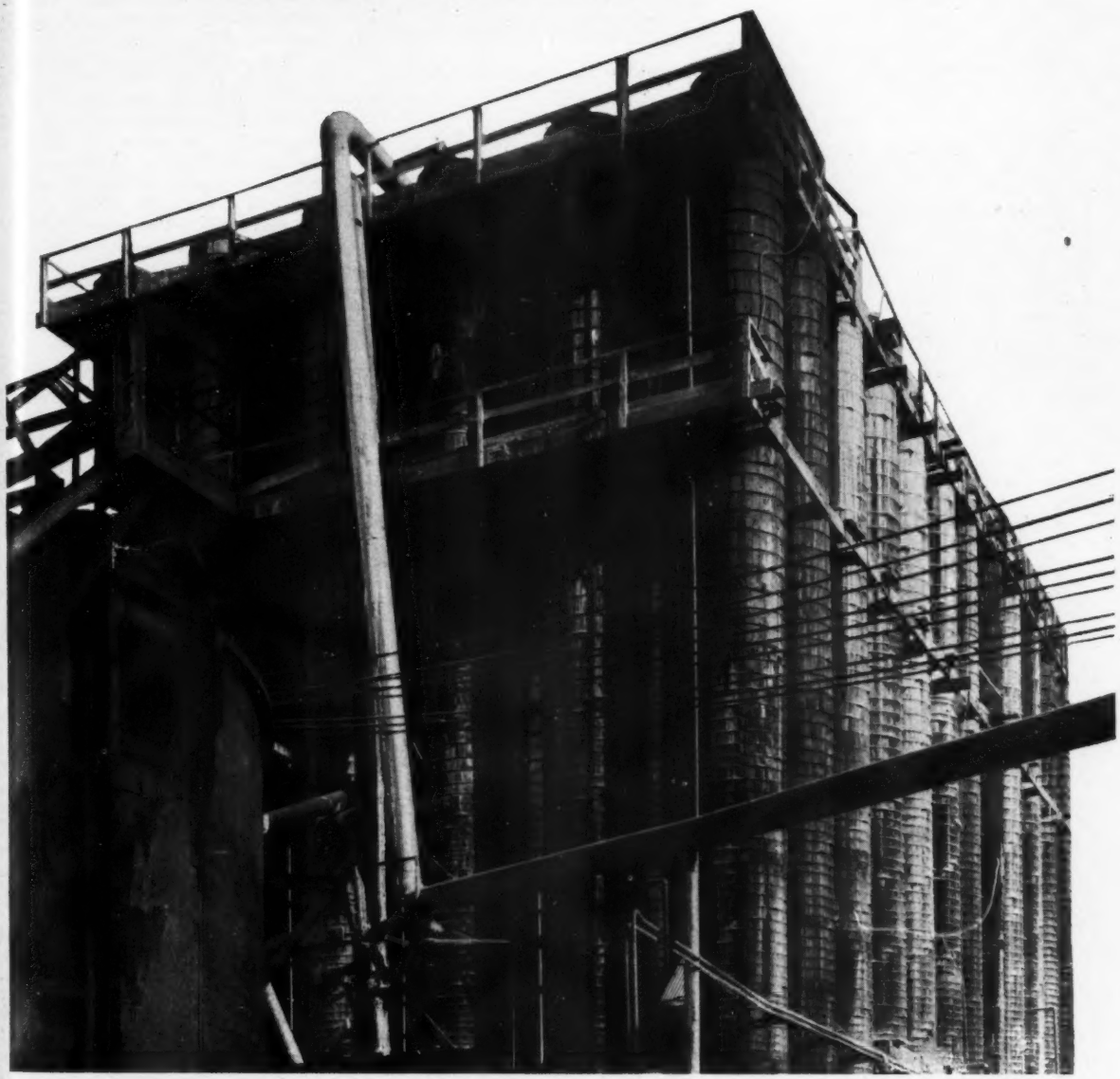
Stocks on hand at the end of February, 1956 were 14,882,000 gross. This is 6.3 per cent higher than the stocks of 13,995,000 gross on hand at the end of January, 1956 and 5.9 per cent higher than the 14,058,000 gross on hand at the end of February, 1955.

Automatic tumbler production during January, 1956 was 5,332,506 dozens. This is a decrease of 2.9 per cent from January, 1955 production which was 5,492,341 dozens. Shipments during January, 1956 dropped to 4,485,766 dozens. This is 8.4 per cent lower than the January, 1955 figure of 4,896,855 dozens. At the end of the 12-month period ending January 31, 1956, shipments rose to reach a total of 62,128,795 dozens, which is only 1.5 per cent lower than the 63,096,013 dozens shipped in the similar period last year.

Table, kitchen and household glassware: Manufacturer's sales of machine-made table, kitchen and household glassware during January, 1956 rose 1.5 per cent over the December, 1955 figures to reach 2,531,214 dozens. This is an 8 per cent decrease when compared with the January, 1955, sales which reached 2,751,588 dozens. At the end of the 12-month period ending January, 1956, total sales were 37,140,451 dozens which is 2.1 per cent below the 37,921,337 dozens sold during the corresponding period last year.

about satisfying details in soda ash orders...

When you write your requirements as to shipping date, routing, acknowledgments and advices into an order, we know you do it for a reason...and that's reason enough for us to pay the very closest attention to every detail. We consider it our responsibility to fill orders exactly as written.



WEST END **West End Chemical Company**

SODA ASH • BORAX • SODIUM SULFATE • SALT CAKE • HYDRATED LIME

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIFORNIA • PLANT, WESTEND, CALIFORNIA

New Equipment and Supplies

HIGH TEMPERATURE INSULATION BLOCK

The Carborundum Company, Niagara Falls, New York, announce the development of a new high heat resistant, lightweight, bonded Fiberfrax ceramic fiber block with improved handling and compressive strength features for high temperature insulation.

Resistant to temperatures up to 2,300° F, and chemically inert, the new F-20 Fiberfrax blocks withstand flame impingement and are unaffected by furnace atmospheres. It has an approximate density of 20 pounds per cubic foot and thermal conductivity is 1.27 BTU/hr., sq. ft. and °F/in. of thickness at a mean temperature of 1000° F; at 2000° F. it is 2.24. An important benefit of the low thermal conductivity is a reduction in heat capacity making furnace equipment more responsive.

The block's greater density results in the improved compressive strength. Under ASTM test C-165, block deformation from a 4.47 psi load is 1 percent. An increase to 13.78 psi causes a deformation of 10 percent. The block's modulus of rupture is 48 psi. When required, treatment with an inorganic compound gives the block a harder skin and boosts its modulus of rupture to 69 psi.

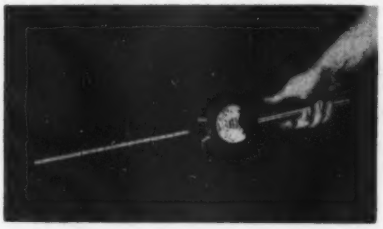
Linear shrinkage after 12 hours soak at 1500° F. is 0.21 per cent; after 24 hours at 2300° F., shrinkage is 3 per cent.

Standard sizes of type F-20 Fiberfrax block are 12″ x 12″, 18″ x 12″, 18″ x 6″, 36″ x 6″ and 36″ x 12″ in thicknesses ranging from 1½″ to 4″ in ½″ increments.

NEW APPLICATION FOR GE POTENTIOMETRIC ROUND-CHART RECORDER

General Electric Company, Instrument Department, Lynn, Massachusetts, announce a new application for the General Electric Potentiometric Round-Chart Recorder. It permits direct reading and recording of "time in process" for continuous ovens, furnaces, kilns and lehrs.

The round-chart recorder is used with a tachometer-generator connected to a conveyor belt drive. The tachometer generator furnishes a signal proportional to the conveyor speed. The reciprocal of speed—time—is the quantity to be recorded, therefore, the tachometer-generator's speed signal must be converted. This is accomplished by a slide wire coupled to the self-balancing potentiometric recorder, which records the process time directly in minutes.



HAND-HELD PROBE TYPE PYROMETER

The Pacific Transducer Corporation, 11836 West Pico Boulevard, Los Angeles 64, California, announces a new hand-held probe pyrometer, for use in all types of non-corrosive metallic and non-metallic liquids, and in atmospheres of furnaces, kilns, ovens and other high heat containers.

Special features of this pyrometer are its lightness and extreme portability. It can be used in heavy service; it has a bright chrome-plated case and handle. This chrome finish provides an external reflective surface that prevents absorption of heat which would normally change the cold junction temperature. A calibrating thermometer is built into the unit and is positioned in the immediate vicinity of the cold junction. The thermocouples are refractory bead insulated of the closed end type. The probe is 19 inches in length and comes in two types. The chromelalumel couple has a range of 2300 °F. (1300° C.). The iron constantan couple has a range to 1600° F. (800° C.). The thermocouples may be easily replaced. The D'Arsonval Meter movement has 2-4/6 inches length of scale and an easy adjustment screw for cold junction temperature.

IMPROVED TYPE MATERIAL LEVEL INDICATOR

Fuller Company, Catasauqua, Pennsylvani, offers an improved type material level indicator for process industries.

The device will function positively at bin temperature up to 300° F. Suitable for all dry, pulverized, fine, crushed or granular materials, it can be used with corrosive materials, with exposed parts of stainless steel.

The improved indicator may be mounted either vertically or horizontally. The mechanism consists of a paddle wheel rotated by a 10-watt electric motor. When incoming material reaches the level of the paddle wheel, shaft movement is restrained. The motor, located externally, revolves on its shaft until it contacts two microswitches, which flash a signal either to the operator or directly to the feed supply. It is available for 110-220 volts, at 25, 50 and 60 cycles.

8000-POUND INDUSTRIAL TRAILER

The Yale & Towne Manufacturing Company, 11,000 Roosevelt Boulevard, Philadelphia 15, Pennsylvania, has developed a new standard 8000 pound capacity industrial trailer which gives the advantages of longer length, with resultant increased carrying area and an improved trailer hitch.

The trailer has a one-piece checkered steel plate carrying platform of 128 inches in length and an overall length of 135⅜ inches. It is available in platform widths of 38 inches and 48 inches. The trailer hitch is a simplified device which is connected or disconnected on either end of the trailer by the removal of a single pin. The model has four-wheel steering, accomplished through levers and connecting rods which assures perfect trailing regardless of the number of trailers in a train.

CATALOGS RECEIVED

Minneapolis-Honeywell Regulator Company, Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pennsylvania, has recently issued the following bulletins: Specification Sheet 866, describing the new Honeywell Ambi-Stat remote bulb temperature controllers; bulletin 7040 describes the company's small case Indicating Pressure Controllers, which are available in ranges from 0-50 to 0-200 psi, with on-off or 10 per cent Throttlor control.

Other Honeywell bulletins cover the Tel-O-Set vertical, scale indicator (bulletin 7202), which also includes up-to-date information on the Tel-O-Set recorders and controllers used to measure and control process variables such as temperature, pressure, flow and liquid level. Specification sheet 242-2 describes mechanical flow meters with evenly graduated charts and scales, and specification Sheet 248 describes Differential Converter mercuryless and liquid level transmitter, with non-bleed pilot relay.

The Farval Corporation, 3249 East Eightieth Street, Cleveland 4, Ohio, have published an 8-page bulletin entitled "Studies in Centralized Lubrication, 1955" which presents a few case studies that indicate the experience of Farval Lubrication users.

Pangborn Corporation, Hagerstown, Maryland, have issued a booklet describing the importance of proper blast cleaning abrasive separation to efficient cleaning room operations. Four types of separators are described in this 8-page booklet (Bulletin No. 1003), which handle from 33,000 to 320,000 lb/hr. of abrasive.

New trends in the use of refractories

Service reports prove economy in installation, economy in use of CAST 400 Bottom Blocks

Proof of savings with CAST 400 Bottom Blocks shows up not just occasionally—but consistently. Here are some examples:

1. 35 months service, producing 109,423 tons of flint glass in one campaign. CAST 400, originally 12″ thick was 4¼″ to 8¼″ thick in the tank bottom at campaign's end.
2. More than 34 months service, producing 199 tons of flint glass per sq. ft. of melting end for the life of the furnace. At campaign's end, CAST 400 was 8 in. thick at the thinnest spot in the bottom!
3. More than 43 months campaign, in 22 in. deep tank, producing 219.8 tons of flint glass per sq. ft. of melting end for the life of the furnace.

Are you getting satisfactory service life with the bottom blocks you are presently using? Are you getting the advantages of CAST 400 Bottom Blocks? When may we talk with you about them?

HKP

LACLEDE-CHRISTY DIVISION

H. K. PORTER COMPANY, INC.

2000 Hampton Avenue · St. Louis 10, Missouri

LACLEDE-CHRISTY COMPANY FOUNDED 1844 Quality First

EVAN EWAN KIMBLE DIES AT 88

Col. E. E. Kimble

Colonel Evan Ewan Kimble died Thursday night, March 15 at his home in Ventnor City, New Jersey, at the age of 88.

In 1901 Evan Ewan Kimble founded the Kimble Glass Company, subsidiary of the Owens-Illinois Glass Company, Toledo, Ohio. For more than four decades, Kimble Glass Company has been manufacturing laboratory and pharmaceutical glassware in this country. Born in 1868, the son of a Tuckahoe, N. J. sea captain, Colonel Kimble went to work at the age of 12 in a Millville, New Jersey glass plant. In the early 90's, young Kimble moved westward, working at plants in Pennsylvania, Ohio and Indiana. In 1901, with three employees and $3,000 capital, most of which was borrowed, he set up his own shop in Chicago. In 1951, Colonel Kimble received the Scientific Apparatus Makers Association Award for his contribution to the American scientific instrument industry and his outstanding work in the chemical glassware field. This was the second time the award had been given by the association.

Colonel Kimble was an early member of Rotary No. 1 in Chicago, a thirty-third degree Mason, a member of Medinah Temple, Chicago, as well as holding a number of other club memberships. He is survived by his widow, the former Carrie Webb Dougherty, a son, Herman K. Kimble, a granddaughter, Mrs. Dale Kimble Ausbrook, a grandson, Evan Ewan Kimble, II, and a great grandson, Michael Kimble Ausbrook.

JOHN H. WRIGHT DIES AT 74

J. H. Wright

John H. Wright, retired vice president of Owens-Illinois Glass Company and former general manager of the Libbey Glass division, died February 28 at the age of 74.

Practically all of Mr. Wright's business career was with Libbey Glass and he was widely known in the table glassware industry. He joined the company as bookkeeper at the Toledo glass plant in 1903. Under his administration, Libbey developed some of the strongest assets of its business. He expedited research that resulted in the successful manufacture of tumblers on the Westlake machine. He backed a pioneer effort that produced a successful process for making stemware on automatic machines. He recognized the growing demand for good, popularly priced glassware and pushed Libbey's development of ceramic colored design for table glassware. The famous Libbey Safedge was another accomplishment of his time.

Mr. Wright was actively associated with Libbey for 43 years until his retirement in 1947. He is survived by his wife Gertrude, a daughter, Mrs. William Black, a sister, Mrs. Clair V. Skinner and four grandchildren.

WILLIAM BAIRD MARBLE, CHAIRMAN OF BOARD LATCHFORD-MARBLE, DIES

William Baird Marble, chairman of the board of the Latchford-Marble Glass Company, died on February 26 following a long illness.

Mr. Marble was the second president of the bottle manufacturing company, which was founded in 1925 by William J. Latchford, Sr. Mr. Marble was also prominent in the activities of the Glass Container Manufacturers Institute.

He is survived by his widow, Mrs. Gladys R. Marble, a son, William Baird Marble, Jr., two daughters, Mrs. Cynthia M. Howes and Miss Sarah Ann Marble, all of Pasadena, California, and a brother, W. J. Latchford, president of the Latchford-Marble Glass Company.

1956 GORDON RESEARCH CONFERENCE ON GLASS

The Gordon Research Conferences of the American Association for the Advancement of Science for 1956 will be held from June 11 to August 31, at Colby Junior College, New London, New Hampshire; New Hampton School, New Hampton, New Hampshire, and Kimball Union Academy, Meriden, New Hampshire. The Conference on Glass is scheduled for August 27-31.

The conferences were established to stimulate research in universities, research foundations and industrial laboratories. This purpose is achieved by an informal type of meeting consisting of scheduled lectures and free discussion groups. Sufficient time is available to stimulate informal discussions among the members of a conference. Meetings are held in the morning and in the evening, Monday through Friday, with the exception of Friday evening. The afternoons are available for recreation, reading or participation in discussion groups as the individual desires. This type of meeting is a valuable means of disseminating information and ideas which otherwise would not be realized through the normal channels of publication and scientific meetings. In addition, scientists in related fields become acquainted and valuable associations are formed resulting in collaboration and cooperative effort between laboratories.

Individuals interested in attending the Conference are requested to send in their applications to the Director. Each applicant must state the institution or company with which he is connected and the type of work in which he is most interested. Attendance at each Conference is limited to 100.

Requests for attendance at the Conferences, or for any additional information should be addressed to W. George Parks, Director, Department of Chemistry, University of Rhode Island, Kingston, Rhode Island. From June 11 to August 31, 1956 mail should be addressed to Colby Junior College, New London, New Hampshire.

The Glass Program, F. W. Preston, Honorary chairman; O. L. Anderson, chairman; T. H. Davies, vice chairman.

Monday, August 27:

General introduction; F. W. PRESTON: subject to be

(*Continued on page* 222)

Supplier *to these industries*

PORCELAIN ENAMEL • GLASS • POTTERY
TILE • DINNERWARE • INORGANIC PIGMENT...

of porcelain enamel frit during *1925*. Simultaneously, production of pottery frit in a separate new plant was started. "HOMELAYA", a white cover coat frit that could be applied directly to steel was given to the enameler in *1929* and soon after our first patents were issued and manufacturing was started on a titanium white cover coat frit *which we introduced* as "TITE-WITE".

The Mellon Institute Fellowship for basic research in ceramics was established in *1933*. Other developments that followed in rapid succession up to World War II included a pottery glaze effect on porcelain enamel, a cup banding machine, a crinkle finish porcelain enamel and "Supersoft" ground coat frit for high speed production. *1946* introduced silica fibre frits followed by low temperature enamels and the Hot Squeegee Machine that greatly increased production in the glass decorating industry. XLT emerged from the research laboratory in *1955*, a new miracle for steel products that will greatly expand many ceramic markets.

We look forward to extending a warm welcome to our many friends at the A.C.S. Convention in the Hommel Hospitality Suite.

THE O. HOMMEL CO.

PITTSBURGH 30, PENNSYLVANIA

West Coast—4747 E. 49th Street, Los Angeles, Calif.

CERAMIC COLORS • CHEMICALS • SUPPLIES

Surface Protection of Malt Bottles . . .

(*Continued from page* 200)

Performance of Tests

All material was first subjected to a controlled atmosphere of 50% relative humidity at 73° F. For each test, a new corrugated fibreboard tray, new carriers and new bottles were used.

The eight loaded cases for each group were individually subjected to controlled impacts performed on the incline impact tester in "progressive fashion" as follows: One end panel of the corrugated tray was subjected to ten impacts from a distance of one foot up the incline of the impact tester. The same end of the tray was then subjected to ten impacts from two feet up the incline, etc., until bottle breakage occurred. The number of foot-falls (a product of the distance up the incline and the number of impacts) was recorded as well as the number of bottles broken within each case. A typical example for computing foot-falls is as follows:

If a container sustained bottle breakage after the sixth impact from four feet (progressive fashion) the total number of foot-falls would be eighty-four. That is, ten impacts from one foot equal ten foot-falls, ten impacts from two feet equal twenty foot-falls, ten impacts from three feet equal thirty foot-falls and six impacts from four feet equal twenty-four foot-falls, for a total of eighty-four footfalls.

Messrs. Shenk and Gentry of Container Corporation of America were present at the laboratory during the performance of some of the impact tests.

Summary of Results

Incline Impact Tests

Group Designation	Average No. of Foot-Falls to Bottle Breakage	Total Number of Broken Bottles
Present 6-Pack Carriers with Regular Bottles	21	9
Proposed 6-pack Carriers with Regular Bottles	30	15
Present 6-Pack Carriers with Silicone-Coated Bottles	82	11
Proposed 6-Pack Carriers with Silicone-Coated Bottles	82	12

Comments

The individual test results on the trays within any of the four major test groupings were quite erratic. It would appear that the major contributing factor to this erratic performance was the bottles themselves. This contention is perhaps supported by the fact that the bottles were of the non-returnable variety.

The tests results clearly showed the superiority of silicone-coated bottles over regular bottles. The average performance of the silicone-coated bottles in either type of carrier was three to four times better than the regular bottles as measured by the number of foot-falls to bottle breakage.

Insofar as the comparison between the two types of 6-pack carriers is concerned, there would appear to be little to choose between the two from the standpoint of durability. The proposed carriers had a slight edge in performance when tests were made with regular bottles but performance of both types of carriers was identical when silicone-coated bottles were tested. However, more bottle breakage was experienced with the proposed carriers than with the present carriers and this was particularly true when tests were made on regular bottles.

In a more recent study conducted by Container Laboratories, Inc. of New York for the Container Corporation of America, twelve-ounce, one-way, export-type beer bottles, both siliconed and unsiliconed, were subjected to a series of incline impact tests.

In these tests which were similar to those of the preceding report, the outstanding superiority of siliconed bottles is clearly defined. The following table indicates average number of foot-falls to bottle breakage.

Carton	Regular Bottles	Siliconed Bottles
A	47.8	259.0
B	43.6	282.0
C	34.0	245.6
D	48.8	310.8
Averages	43.6	286.9

In the summary of their report, Container Laboratories state, "the test results clearly showed the superiority of silicone-coated bottles over regular bottles. The average performance of the silicone-coated bottles was close to six times better than the regular bottles as measured by the number of foot-falls to bottle breakage."

APPROVED BY:

ALLYN C. BEARDSELL, Vice President
CONTAINER LABORATORIES, INC.

JEROME J. KIPNESS, Laboratory Supervisor

Durability of Silicone Film

It has been determined by tests conducted by The Canadian Breweries, Ltd. that the silicone film remains intact for at least ten trips through a soaker whose caustic concentration is about 5%. The film continues giving some protection up until about 15 to 20 trips. A comparison of the amount of surface damage resulting from repeated trips through a soaker has shown that 20 trips are required before the siliconed bottle treated with DC 4141 has received the same amount of damage as has a sulfured container after only five trips. While the life of a returnable bottle is also dependent upon variables other than strength, the decreased abrasion resulting from silicone apparently gives the possibility of considerable extra trippage.

Labelling

As was mentioned previously, if the siliconed bottle is sent through a caustic soaker, there are no changes in adhesives or labelling procedures required. Canadian Breweries, Ltd. has run about 4,000 gross of bottles treated with various silicones and no labelling or adhesive problems were encountered. DC 4141 silicone fluid is used for returnable bottles because of its caustic durability.

(*Continued on page* 222)

NEW TYPE ELECTRO-PERMANENT MAGNETIC HI-VI VIBRATORY EQUIPMENT INTRODUCED BY ERIEZ

No Rectifier Needed!
Exclusive "Double Action" Drive
Gives Superior Performance
at Lower Operating Costs!

Eriez, famous for permanent-powered magnetic equipment for industry, introduces a revolutionary line of Electro-PERMANENT Magnetic Unit (Bin) Vibrators and Feeders. Operating at 3600 CPM directly off an AC line, all you do to these powerful, compact units is plug them in . . . and they go to work! THERE'S NO RECTIFIER NEEDED!

Look at HI-VI's Many Operating Advantages

LOWER MAINTENANCE and OPERATING COSTS . . . LONGER, TROUBLE-FREE SERVICE . . . VERSATILE UNITS PROVIDE BROADER OPERATING RANGES WITH LESS POWER CONSUMPTION . . . HI-VI UNITS ARE COMPACT, LIGHTWEIGHT, EASILY INSTALLED, NEED NO REALIGNING . . . NO SLIDING OR ROTATING PARTS TO WEAR . . . No lubricants needed . . . Noise factor is reduced, working conditions improved . . . New type "double action" drive provides higher operating efficiency with low operating cost . . . Many HI-VI models are totally enclosed, weather-and dust-resistant.

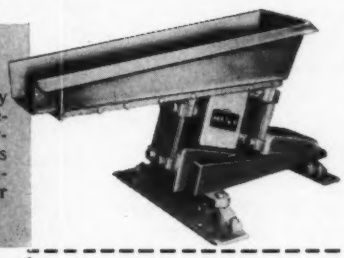
Pat. Pending

HI-VI Unit (bin) Vibrators . . . keep materials flowing freely

Units AUTOMATICALLY SELF-ADJUST to meet any load requirements. They eliminate pile-ups, sticking, bridging and arching of bulk materials flowing out of or through containers. Materials are kept flowing in a smooth, steady stream through hoppers, bins, chutes, etc., by the exclusive double diaphragming (kneading) action of the HI-VI unit.

HI-VI's operating principle

The heart of the HI-VI units is a permanently powered Alnico V magnetic element. This replaces, in effect, rectifiers by providing an inherent magnetic rectification system which provides more operating forces, no lost efficiency. All energy (two-way push-pull vibrating action) goes for productive performance.



HI-VI Vibratory Feeders . . . for accurate, controlled feed

Bulk materials are conveyed, spread, agitated, separated, blended, dried and mixed —automatically—by the vibratory action of the HI-VI Feeder. Unit requires little space, and operates at any desired speed, variable from ounces to tons per hour. For all types of materials: hot, dry, damp, dusty, lumpy, abrasive, etc.

ERIEZ HI-POWR MAGNETIC SEPARATORS

ERIEZ HI-VI VIBRATORY EQUIPMENT

HI-VI is the newest product of the Eriez Manufacturing Company, pioneer producer of permanent-powered magnetic Separators for industry. Eriez HI-POWR Magnets are used to purify, retrieve and separate in processing lines of all types, and are available in a wide range of styles and sizes.

ERIEZ MANUFACTURING COMPANY
112D MAGNET DR., ERIE, PA.

Please send information on the new HI-VI vibratory equipment to:

NAME .....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....

Surface Protection of Malt Bottles . . .

(*Continued from page* 220)

In the case of non-returnable bottles which will not be washed, it is suggested that label tests be made with the recommended adhesives before large scale runs of siliconed ware are made.

Considerable progress is being made by the adhesive manufacturers on this problem. It is objectionable now only because the precaution of obtaining proper glue is required. Satisfactory labelling will result if this precaution is taken.

Effects of Silicones on Beer

Tests made by the laboratories of the National Brewing Company and Canadian Breweries, Ltd. have shown that the siliconed container has no effect on beer, or any of its properties. These tests were all conducted on bottles which had been siliconed much more heavily on the inside than is possible during regular manufacture.

There is no question of product contamination, of course, with containers which have been siliconed only on the outside. From tests with containers which have been siliconed on the inside as well as the outside, it has been found that the leaching of the silicone into the product approached zero, the uptake being less than 0.1 parts per million for all products tested except those having a pH higher than 6.5.

The extraction data above have been submitted to the Food and Drug Administration and copies of that agency's opinion may be obtained by writing to the Brockway Glass Company.

Conclusions

It is believed on the basis of actual production experience that the siliconed glass container represents a real contribution to the glass container industry. This treatment is available at no extra cost to the packer. The savings in cost that it makes possible because of reduced breakage during filling and shipping, decreased line down-time and product loss can be considerable.

Further advances in light-weighting of containers and paper savings due to carton redesign are also stimulated by this surface protection.

It is our belief that the surface treatment for strength preservation of all glass articles will become a regular feature in the near future. Brockway Glass will continue research in this field in order that the most effective and best techniques will be available to our customers.

J. T. LANAHAN APPOINTED DIRECTOR OF EMPLOYEE INFORMATION AT CORNING

John T. Lanahan has been appointed to the newly created position of director of employee information for Corning Glass Works, it was announced by Thomas Waaland, vice president and director of industrial relations.

Mr. Lanahan has specialized in the employee relations and community aspects of communications in his duties with the company and formerly was assistant public relations director of Corning Glass Works. In his new post he will be in charge of the company's expanding program of employee communications, including monthly policy meetings for management personnel.

1956 Gordon Research Conference . . .

(*Continued from page* 216)

announced; speaker to be announced; report on International Congress on Glass; E. B. SHAND, Chairman: Time and Temperature Effects; T. C. BAKER: Strength Dependence on Temperature; G. S. HORSLEY: Unpublished Results on Static Fatigue Out to Two Years.

Tuesday, August 28:

G. H. MACHLIN, Chairman: High Breaking Strength; W. H. OTTO: Properties of High Strength Fibers; R. M. WITUCKI: Report on High Strength Bulk Glass; O. C. HANSEN: Report on High Strength Fibers; J. E. BURKE, Chairman: Classical View on Strength; E. OROWAN: Critique of Griffith Flaw Theory; Speaker to be announced: The Size Effect on Flaw Distribution.

Wednesday, August 29:

S. BATESON, Chairman: Flaws and Their Detection; W. R. PRINDLE: Surface Flaws by the Electron Microscope; M. B. HOGAN: Stress Concentrators; M. HIRATA: Growth of Rapid Fracture; L. G. GERHING, Chairman: Fracture Diagnosis; E. F. PONCELET: Fracture Propagation; H. KOLSKY: High Speed Phototgraphy.

Thursday, August 30:

S. W. MICHENER, Chairman: Surfaces; E. U. CONDON: Subject to be announced; W. F. KOEHLER: Geometry of Glass Surfaces; H. E. SIMPSON, Chairman: Surfaces; Speakers to be announced: Chemical Reactivity of Glass Surfaces; the Use of Tracers.

Friday, August 31:

Speaker to be announced: Ionic Diffusion in Surface; Speaker to be announced: Coupling of Protective Films and Organic Films to Glass.

HARBISON-WALKER PURCHASES INTEREST IN MEXICO

E. A. Garber, president of Harbison-Walker Refractories Company announced that the company has purchased an interest in Fabrica de Ladrillos Industriales y Refractarios, S. A., (Flir) of Mexico. The firm is a subsidiary of Cia. Fundidora de Fierro y Acero de Monterrey, S. A. The name will change to Harbison-Walker-Flir, S.A.

Harbison-Walker-Flir, S. A. is expected to supply a substantial share of the refractories requirements of Mexican industry, according to Mr. Garber. The firm produces fireclay and silica refractories in a modern plant at Monterrey, Mexico. The plant now is in process of enlargement. Mexican personnel will continue to operate the plant, but in the future Harbison-Walker will supply technical management.

● President M. Ellis Drake of Alfred University has just announced the establishment of a graduate program leading to the degree of doctor of philosophy in ceramics at State University of New York College of Ceramics at Alfred University. The program will place special emphasis on fundamental research in ceramics, solid state physics, solid state chemistry and the earth sciences

Fired-on color labels

Put sell into staples!

The eye-appeal of an attractive design is a big factor in moving products off self-service shelves . . . and fired-on color labels have proved their ability to invite those impulse purchases. In addition, permanence and clarity of printed directions are assured. Correct usage means best results . . . results keep customers sold.

New developments in manufacturing and application processes promise newer and brighter colors in a wider range of design . . . at far less cost than before.

Find out how fired-on color labels can give added selling power to your product. See your glass supplier or the Pemco Representative in your territory.

this

is your

advertisement!

...poration

BALTIMORE 24, MARYLAND

HOT OIL COLORS • CONVENTIONAL COLORS • SCREENING PASTES • SATIN ETCH COLORS

It's directed to your customers and they are told to see you for more information on how many sales producing advantages result from new developments in colors and application techniques of Fired-on Color Labels.

Is your information on all these advantages up-to-date? If not, you can get all the latest data simply by writing Pemco direct, or by contacting your nearest Pemco Sales Representative. Write for "Glass Colors by Pemco" with Technical Supplement.

CORPORATION • BALTIMORE 24, MARYLAND

HOT OIL COLORS • COLD COLORS • SCREENING PASTES
SATIN ETCH • COLORS • GLAZE FRITS • PORCELAIN ENAMEL FRITS

Inventions and Inventors

(*Continued from page* 209)

Luminescent materials obtained by means of calcium-strontium-silicates have a considerably higher red proportion of the emission than do calcium silicates having the same concentration of activators.

There were 11 claims and the following references: 2,445,692, Porter et al., July 20, 1948; 2,447,210, Roberts, Aug. 17, 1948; 2,450,548, Gisolf et al., Oct. 5, 1948; and 577,694, Great Britain, May 28, 1946.

Tube and Cane Machines

Fluorescent Coating Method. Patent No. 2,726,966. Filed April 27, 1954. Issued December 13, 1955. No drawings. Assigned to General Electric Co., by J. T. Anderson and H. F. Ward.

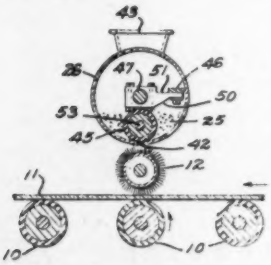
This invention relates to the coating of support surfaces with a luminescent material.

A vehicle is first prepared by making a water solution of a water-soluble cellulose derivative such as methyl cellulose or glycol cellulose diluted to obtain the required viscosity. A suspension is then made up with the vehicle and a luminescent powder such as a silicate, tungstate, phosphate, or borate or a mixture thereof, dispersed in it and about one percent of the wetting agent is then addcd. For the purpose of coating the interior surface of a tube for use in making a fluorescent lamp, the coating is effected by raising the suspension into the tube held vertically by air pressure and then allowing the tube to drain. The deposit is dried by placing in a warm air stream. The tube is then heated to a temperature of 410-450°C over a period of 3 to 10 minutes, a slow air stream being passed through it, in order to remove the residuum of the vehicle. The upper limit of temperature is determined by the necessity for avoiding softening of the glass. The coating process is complete.

There were 3 claims and the following references cited in this patent: 1,244,058, Langer, Oct. 23, 1917; 2,297,-033, Stahr, Sept. 29, 1942; 2,317,977, Casellini, May 4, 1943; 2,512,866, Mager, June 27, 1950; 2,524,733, Payne et al., Oct. 3, 1950; 2,621,134, Welch, Dec. 9, 1952; and 2,676,894, Anderson et al., Apr. 27, 1954.

Miscellaneous Processes

Mirror Making Apparatus. Fig. 2. Patent No. 2,702,969. Filed October 26, 1951. Issued March 1, 1955. Three sheets of drawings. Assigned to W. P. Fuller & Company by Max Klaar.



This invention relates to improvements in automatic mirror making machines and has particular relation to a device for cleaning the glass preparatory to application of the silvering solution. Prior to the invention the cleaning of the glass to remove any dirt or imperfections was done by hand. The object of this machine is to provide means for applying a uniform amount of cleaning compound to the whole upper face of the glass sheet without injuring the delicate surface that is to be silvered. As shown in Fig. 2 the rouge applicator 12 rotates and moves in a counterclockwise direction across the glass sheet as it treats the surface. The applicator and scrubbing brush 12 picks up the cleaning compound in the specially designed magazine that distributes the cleaning compound evenly; the compound being fed by the roller 45 through the holes 42. The oscillatory and rotational movement of the applicator assures that every bristle will receive its share of the rouge supplied. Movement of the blade 46 assures the operator that the rouge in the hopper will be moved down into range of the roller 45. The net effect on the glass sheet of passing under the cleaning compound applicator and scrubbing brush just prior to being washed thoroughly is that any dirt, glue, fingerprints, or other foreign matter which have adhered to the glass sheet between the time of its manufacture and the time it is treated by this machine will be removed and the upper glass surface on which the silver coating is to be applied will be thoroughly cleaned over its whole area.

The patent contains 9 claims and 11 references.

NBS ANNOUNCES NEW PUBLICATION

The ISCC-NBS Method of Designating Colors and a Dictionary of Color Names, by Kenneth L. Kelly and Deane B. Judd, National Bureau of Standards Circular 553, 158 pages, $2.00. (Order from the Government Printing Office, Washington 25, D. C.)

The circular is designed to assist the scientist, businessman, and layman to understand the different color vocabularies used in the many fields of art, science and industry. The dictionary serves not only as a record of the meanings of the 7,500 individual color names listed but also enables anyone to translate from one color vocabulary to another. For example, the dictionary shows that Griseo-Viridis (biology)—Serpentine (fashion)—Mint Green (mass market), or in ordinary language, a light green.

The terms by which this dictionary defines color names are those of a refinement of the method of designating colors outlined by the Inter-Society Color Council (ISCC) and developed at the National Bureau of Standards. The system applies not only to the colors of drugs and chemicals, for which it was originally developed, but to the colors of all opaque, clear, cloudy, or fluorescent samples, whether viewed by reflected or transmitted light, and to microscopic structures.

Note: Foreign remittances must be in U. S. exchange and should include an additional one-third of the publicatiotn price to cover mailing costs.

GCMI TO MEET IN WHITE SULPHUR SPRINGS

The 1956 Spring meeting will be held at The Greenbrier, White Sulphur Springs, West Virginia, Monday, Tuesday and Wednesday, May 21, 22 and 23.

● Dr. Alexander Silvermab, Professor of Chemistry Emeritus in the University of Pittsburgh, will visit England in April. From April 11 to 20 he will preside at sessions of the Commission on Inorganic Chemical Nomenclature of the International Union of Pure and Applied Chemistry. On April 23, he will visit the Department of Glass Technology of the University of Sheffield, where he will participate in the annual meeting program of the Society of Glass Technology of England.

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Recent Russian Translations . . .

(*Continued from page* 206)

It stands to reason that the largest grains are more important than the smaller ones, because the former carry the whole pressure of the grinding disk. Experiments show that, of the grains present at any moment between the disk and the glass, only 5 to 10 per cent take part in the grinding process. This fraction consists of the largest grains present, while the particles of the average size have only a secondary importance.

Temperature Resistance of Glass and Mineral Fibers

A new quicker method to determine the temperature resistance of rock wool and glass fibers was worked out by I. Z. Volchek, as reported in *Steklo i Keramika* (*Glass and Ceramics*) vol. **11,** No. 5, p. 27 (1954).

A layer of fibers kept under a pressure of 20 g/cm^2 is heated at a constant rate. When a non-elastic deformation is observed (which can be determined within 0.01 mm) the highest temperature of heat stability is reached. The pressure of 20 g/cm^2 is chosen as it corresponds to the pressure on heat insulating materials encountered in construction.

The glass fibers have the composition Si_2 72.0, Al_2O_3 1.50, CaO 7.5, MgO 3.0, Na_2O 15.0 per cent. The average diameter of the glass fibers is 15μ, and of the rock wool samples 6.5-8.3μ.

For glass fibers the highest temperature of heat stability is reached at 330°C, which is much lower than that of rock wool fibers: e.g., fibers of acid slag (SiO_2 38.15, Al_2O_3 18.03, Fe_2O_3 0.94, CaO 39.10, MgO 1.89, MnO 2.12, SO_3 0.17 per cent) have 680°C, synthetic fibers (SiO_2 6.93, Al_2O_3 46.46, CaO 47.1 per cent) have 840°C, and fibers of dolomite and clay (SiO_2 44.35, Al_2O_3 13.12, Fe_2O_3 4.71, CaO 27.5, MgO 9.06, MnO 0.30, SO_3 0.20 per cent) have 570°C as the highest temperature of heat stability.

This could be explained by the content of alkali metal oxides in the glass composition. The rock wool fibers contained no alkali.

Glass Rings as Fillers in Gas Scrubbers

V. A. Ulazovskii in *Steklo i Keramika* (*Glass and Ceramics*) vol. **11,** No. 5, p. 31 (1954) recommends the use of glass rings in the water scrubbers of gas generators. The wetting of glass rings by tar at 40-80° C, is very poor, so that they can easily be cleaned.

The glass rings used in a gas generator in Gomel were 120x70 mm, set in two layers of 6 rows of rings each.

An advantage of the suggestion is that the rings are made from rejected glass tubing; thus, valueless waste is put to use.

● Dr. Hal B. H. Cooper has joined American Potash & Chemical Corporation in the newly created position of director of Development Engineering, according to an announcement by Dan S. Dinsmoor, vice president in charge of Research and Development. Mr. Cooper will be in charge of special engineering phases of new projects and developments at various company plants and will act as engineering advisor on pilot plant research operations.

CHANGES AT WESTVACO

J. M. Richard

The pioneering research activity of Food Machinery and Chemical Corporation's Westvaco Chlor-Alkali Division is being transferred to, and will become a part of, the FMC Chemicals Central Research laboratory now under construction at Princeton, N. J., Franklin Farley, FMC's Westvaco Chlor-Alkali division president, announced today. Dr. W. L. Davidson, former Chlor-Alkali research director, has been appointed assistant director of the Princeton laboratory.

The research and development departments of Chlor-Alkali Division will be consolidated under the direction of William B. Rose, former development manager, whose headquarters will be at the South Charleston, West Va. plant of the division.

Robert A. Bondurant, former staff assistant to the division president, becomes general service superintendent at the South Charleston, West Va. plant of Chlor-Alkali Division.

As reported in the March issue of THE GLASS INDUSTRY, James G. Bronson, former product manager of chlorine and alkali sales, becomes staff assistant to the president of Chlor-Alkali Division in N. Y.

John M. Richard, former product manager of phosphate sales in FMC's Westvaco Mineral Products Division becomes product manager of chlorine and alkali sales in the New York headquarters of Chlor-Alkali Division.

P. B. DELLISANTE PROMOTED AT CORNING GLASS

P. B. Dellisante

The appointment of Philip B. Dellisante as controller of the Refractories Division at Corning Glass Works was announced by Edward C. Leibig, general manager of the division.

Before his appointment Mr. Dellisante was staff accountant in the Electrical Products Division. He joined the company in 1941 as a production worker in the main plant and left in July 1943 to join the Army. Returning in March 1950, he worked as process data clerk in the main plant and shortly afterward became product cost estimator in the Pressware plant.

In July 1951 he was appointed budget analyst and in May 1952 became supervisor of accounting clerks in Pressware. He had been staff accountant of the Electrical Products Division since September 1952. Mr. Dellisante is a native of Corning.

● John A. Sargent, president of Diamond Alkali Company, has been elected a director of The White Motor Company.

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DIAMOND ALKALI CHEMICALS

Diamond Chemicals

Wetting Phenomena—For Adhesion . . .

(*Continued from page* 203)

Table V—Contact Angles Examination of Delaminated Surfaces in Relation to Adhesion

Adhesive Composition	Contact Angle of Respective Delaminated Surface		Adhesion	
	Vinyl (Degrees)	Cast Phenyl (Degrees)	Tensile Strength (psi)	Crush Test
Vinylite 28-18, Butacite and BV-1112	35-37	30-33	900	B+
Vinylite XYHL, BV-1112 in Alcohol	47-50	45-46	1300	A+
Vinylite 28-18 BV-1112 Arochlor 1262	30-32	29-30	1000	A
Vinylite 28-18 Epon 1004	30-33	10-15	100	N.G.
Tung Oil Modified Phenol and Butyral	20-22	58-60	100	N.G.

tional groups are available in the mixture for alignment, than in the pure resins. However, in some cases the film thickness masks the orientation, and the coated surface gives the same contact angle on all surfaces.

Additional illustrations of the use of wetting, to predict adhesion, are shown in Table V. The attaching of a polar vinyl film, having a 20 degree contact angle, to a 43 to 45 degree cast phenolic surface requires a mixture containing a low contact angle material and a moderately non-polar polymer. Such a combination may be obtained by combining a phenolic, BV-1112, with either a copolymer vinyl-chloride-acetate-alcohol, or with a medium molecular weight polyvinyl butyral. These formulations are listed in Table IV and adhesion is evaluated by the falling ball crush test for laminates, and also by a tensile value.

Contact angles on the delaminated Vinal and phenolic surfaces show the type of adhesion secured. If the contact angles of both adhesives are approximately the same, cohesive failure has occurred and the adhesive has functional groups compatible with both surfaces. However, in case of adhesion failure, the Vinal surface will have its original contact angle, while the phenolic surface contains the adhesive film having a different contact angle than its initial surface. This is illustrated by the Tung-oil modified phenol-butyral adhesive. These results correlate with either the falling ball test or the tensile test. The Vinylite BV-1112 formulation gives A to A+ adhesion, and 1000 to 1300 psi in tensile, whereas the modified phenolic-butyral gives no adhesion by the falling ball test and approximately 100 psi in tensile. Therefore, contact angle measurements as described help to predict the adhesion and nature of the adhesive bond.

(*Continued on page* 232)

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Annual A.C.S. Meeting . . .

(*Continued from page* 194)

Gupta and Robert L. Hess, University of Michigan, Ann Arbor, Mich.

10. Measurements of Dielectric Loss of Glass at Low Frequencies. H. T. Smyth and W. C. Lo, School of Ceramics, Rutgers University, New Brunswick, N. J.
11. Modulus As a Function of Temperature and Thermal History by a Vibrating Reed Method. Michael Yamin, Mellon Institute of Industrial Research, Pittsburgh, Pa.
12. Two Peaks in the Internal Friction as a Function of Temperature in Some Sodium Silicate Glasses. K. E. Forry, Owens-Illinois Glass Company, Toledo, Ohio.
13. Precision Glass, Fabrication and Uses. Oscar H. Grauer and William Conway, Fischer and Porter Company, Hatboro, Pa.
14. Electron Tube Ceramic Requirements and Manufacturing Considerations. A. G. Reimann, Tube Department, General Electric Company, Schenectady, N. Y.
15. Four Functional Zones in Glass Tanks. L. Penberthy and L. Miller, Penberthy Electromelt Company, Seattle 16, Wash.
16. The Contributions of Electric Melting and Boosting to Glass Technology. P. La Burthe and G. de Piolenc, Saint-Gobain Incorporated, New York 36, N. Y.
17. A Study of the Surface Structure of Glass as Related to Its Durability. H. E. Simpson, New York State College of Ceramics, Alfred, N. Y.
18. Thermal Expansivity of Binary Alkali Silicate and Alkaline Earth Borate Glasses. H. F. Shermer, National Bureau of Standards, Washington 25, D. C.
19. The Inadequacy of the Fictive Temperature Concept. H. N. Ritland, Corning Glass Works, Corning, N. Y.
20. Structural Interpretation of Low-Temperature Heat Capacities of Silica. S. W. Barber and M. Dank, Owens-Illinois Glass Company, Toledo, Ohio.
21. Interaction of Alkali and Alkaline-Earth-Ions in Simple Silicate Glasses. Rajeshwar K. Gupta and Robert L. Hess, University of Michigan, Ann Arbor, Mich.
22. Structural Interpretation of Immiscibility in Glass Systems. Part I. Analysis and Calculations of Immiscibility. Ernest M. Levin and Stanley Block, National Bureau of Standards, Washington 25, D. C.
23. Structural Interpretation of Immiscibility in Glass Systems. Part II: Coordination Principles Applied to Immiscibility. Stanley Block and Ernest M. Levin, National Bureau of Standards, Washington 25, D. C.
24. A Possible Explanation of Immiscibility in Silicate Melts. E. C. deWys, Owens-Corning Fiberglas Corporation, Newark, Ohio.

Following the keynote, "Basic Refractories in Glass Tank Furnace Regenerators" by T. B. Montgomery and J. S. Gregorius, Pittsburgh Plate Glass Company, at the joint session of the Glass and Refractories Divisions, the six papers offered by the Glass Division are:

7. Correlating Glass Furnace Operation and Basic Refractories. J. J. Webber, Harbison-Walker Refractories Company, Pittsburgh, Pa.
8. Mineral Placement of Constituents in Five Types of Basic Brick. N. B. Dodge, United States Steel Corporation, Monroeville, Pa.
9. Regeneration Efficiency and Basic Brick in a Glass Furnace. L. F. Robertson, John J. McMackin, and Frank V. Halvonik, Brockway Glass Company, Inc., Brockway, Pa.
10. How Long Will Basic Last? Henry E. Walker, Harding Glass Company, Fort Smith, Ark.
11. Basic Brick Applications in High Temperature Furnaces. C. E. Grigsby and R. G. Abbey, General Refractories Company, Philadelphia, Pa.
12. Basic Refractories in Glass Furnace Regenerators. F. G. Heck, E. J. Lavino & Co., Philadelphia, Pa.

In the Materials and Equipment Division two papers to be presented which may be of interest to glassmen are "Future Strategic Materials" by Thomas S. Rogers, Rogers and Sons, Washington, D. C. and "Borax and Boron Compounds" by Robert M. Curts, American Potash and Chemical Corporation. Mr. Curts will discuss methods of recovery and refining, current supply and other highlights of the industry.

"Modern Stained Glass-Craft of the Middle Ages Meeting the Challenge of Our Modern Idiom" will be delivered by Robert Rambusch, Rambusch Decorating Company under the auspices of the Design Division.

The usual pattern of entertainment and social events have been planned for the meeting.

DR. WEIDLEIN RETIRES FROM MELLON

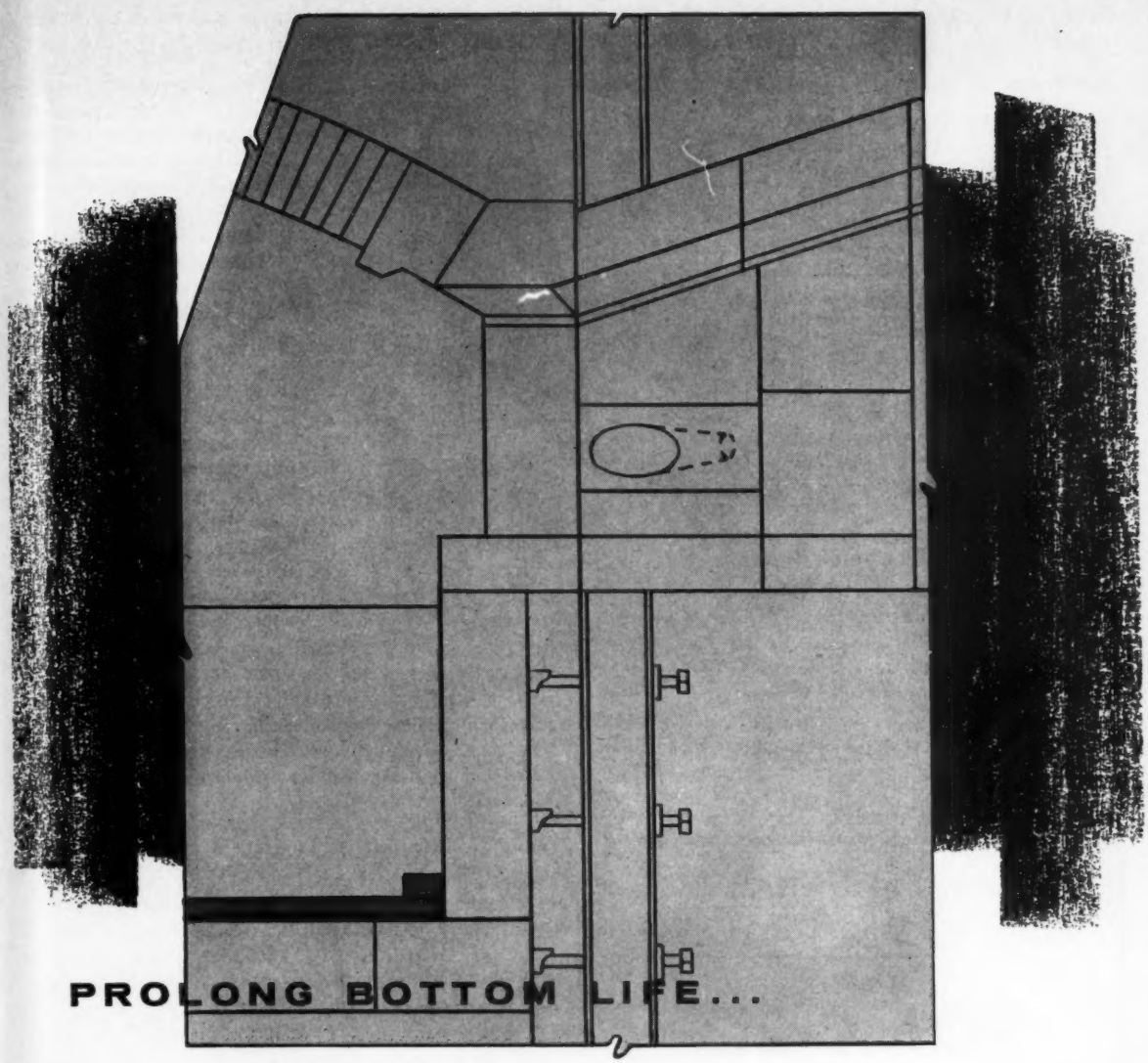
At the testimonial dinner tendered to Dr. Edward R. Weidlein by the members of Mellon Institute, at the Schenley Park Hotel, Pittsburgh, Pennsylvania, announcement was made of his retirement on March 31.

Dr. Weidlein has been prominently and actively identified with the Institute for over forty years, serving as a senior fellow, 1912-1916, and then as an executive staff member from 1916 to 1951, when he was made president of the scientific research organization. Dr. Weidlein is noted internationally as a scientist, research administrator and author. Following his retirement he will spend several months in Europe on a Federal Government mission. He will remain on the board of trustees of the Institute and will be available in an advisory capacity in the administration of the Institute's research programs.

NEW DIVISION AT CORNING

William C. Decker, president of Corning Glass Works has announced the establishment of a new division of Corning Glass Works, to be known as the Division of Public Affairs. The division will be responsible for all activities of the Corning Glass Center as well as the other public relations of the company.

James M. Brown has been appointed director of the new division. Mr. Brown has held the office of vice president of The Corning Museum of Glass since 1952 and will continue to be associated with the museum in that capacity.



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Wetting Phenomena—For Adhesion . . .

(*Continued fom page* 228)

Summary

Contact angles for solid surfaces and for resinous films were measured. Illustrations are given for using the data for formulating adhesives for respective surfaces. Wetting properties of polymer films and delaminated surfaces in air-water systems were illustrated as a means for predicting adhesion and the nature of the bond.

R. C. LANGSETT PROMOTED

Robert C. Langsett has been named assistant to the manager of Glass Container Sales of the Armstrong Cork Company's Glass and Closure Division.

Mr. Langsett joined the company as a sales trainee in 1947 after receiving a master's degree in business administration from the University of California. He has had sales assignments in Philadelphia and San Diego.

CHUCKOVITS NAMED INDUSTRIAL RELATIONS MANAGER AT O-I

Charles H. Chuckovits has been promoted to industrial relations manager for the Toledo, Ohio plant of the Libbey Glass Division of Owens-Illinois.

Mr. Chuckovits with the company since 1947, had been warehouse and shipping supervisor since 1951. The position of industrial relations manager is a newly created post and Mr. Chuckovits will be in charge of all phases of the personnel program and labor relations.

H. B. DUBOIS APPOINTED SALES MANAGER OF GOLDING-KEENE COMPANY

H. B. DuBois

The Golding-Keene Company recently announced the appointment of Hascall B. DuBois as sales manager of the company, which has feldspar and mica operations at Keene, New Hampshire, Trenton, New Jersey and Camden, New Jersey. In addition to managing the American sales, Mr. DuBois will also handle the export sales for the parent corporation, Spar-Mica Corporation Ltd., of Montreal and Baie Johan Beetz, Quebec.

Mr. DuBois is well known in the feldspar and mica fields and in the glass and ceramic industries. He is a graduate from the New York State College of Ceramics at Alfred, New York, and is a Fellow of the American Ceramic Society, and a former trustee and vice president of the American Ceramic Society. He has been connected with Consolidated Feldspar Corporation since 1929 and was vice president and sales manager of that corporation until it was purchased by International Minerals & Chemical Corporation. Since that time he has been sales manager and assistant manager respectively of the Consolidated Feldspar Department of International Minerals & Chemical Corporation.

● Pittsburgh Plate Glass Company has created a new division called the Building Products Sales department in order to serve the industry more effectively. Building products to be serviced by the new department are Carrara glass, Herculite doors and panels, store front construction operations, etc. George L. West will be manager of this department.

● The Deutsche Glastechnische Gesellschaft 30th meeting will take place May 15 to 17, 1956 in Tuebingen, Germany. The main meeting will open the morning of the fifteenth, and the afternoon sessions of the fifteenth and sixteenth will be devoted to technical reviews. An excursion is planned for May 17.

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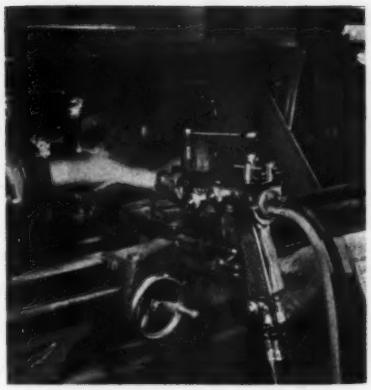
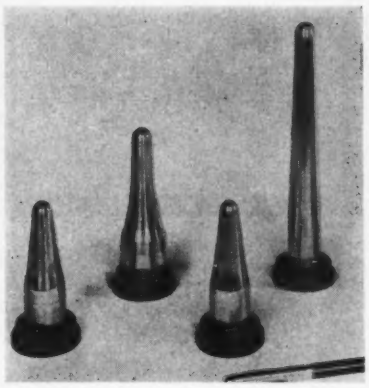


Here a plunger is being hard-faced with the Colmonoy Spraywelder, using Colmonoy No. 4 alloy powder. The Spraywelder provides a perfectly controlled method of applying an even overlay of wear resistant alloy. Three grades of Colmonoy alloys are available for Spraywelding.



Many types of glass plungers can be hard-faced with the Colmonoy Spraywelder, using Colmonoy nickel-alloy powders. Air-cooled press-and-blow plungers (pictured) that once lasted only 5 hours, now last more than 200 hours after hard-facing. Request Engineering Data Sheet No. 34.

Colmonoy No. 20 is now the accepted material for repairing glass moulds, neck rings, and related cast iron parts. Chipped areas, surface cracks and flaws are all easily filled and refinished with Colmonoy No. 20 oxy-acetylene rod. Request Engineering Data Sheet No. 36.

Thimble inserts made of cast Colmonoy No. 4 or 20 last up to three times as long as do the cast iron thimbles alone. Inserts in a wide variety of sizes are available from stock. Easily machined to exact size, they are press fitted into place. Request Engineering Data Sheet No. 42.

Other Colmonoy Applications

PART	ALLOY
Cullet Chutes	Colmonoy Sweat-on Paste fused by oxy-acetylene flame
Cullet Hammers	Colmonoy No. 1 electrodes
Timing Buttons	Colmonoy No. 6 oxy-acetylene rod
Blowheads	Colmonoy No. 4 Sprayweld
Baffles	Colmonoy No. 4 Sprayweld

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Flow in Glass Tanks

(*Continued from page* 193)

proved melting ability. Actually, batch can be allowed to proceed several feet further toward the bridgewall and a greater portion of the melter used for melting. All ports become adjuncts to melting rather than holding temperature. Changes are usually necessary in shadow wall construction in order to maintain proper refiner temperatures.

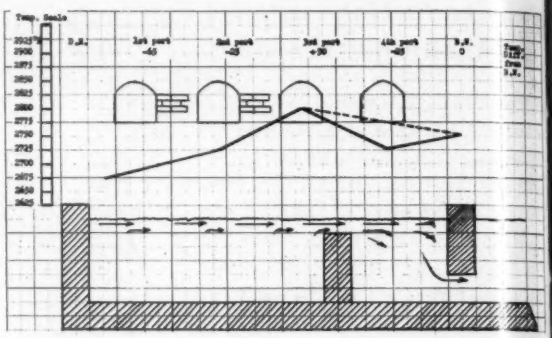

Fig. 7. Dam construction to create surface flow.

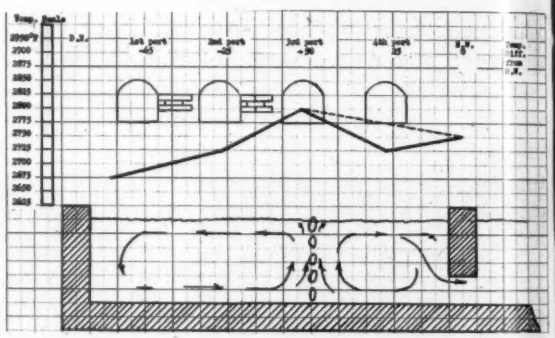

Fig. 8. Influence of bubblers on convection flow.

Other Methods of Combating Mechanical Currents

Undoubtedly, there are other corrective measures that may be applied to offset the influence of mechanical currents. Two are briefly discussed here.

The lateral current created by flow through throat at the bottom of a tank may be changed by simply constructing a dam as shown in Figure 7. Here is illustrated how the lateral bottom flow is completely neutralized. It is felt that this is probably the most positive means of correction although consideration must be given to such factors as devitrification.

There are certain furnaces, now in operation, having no bridgewall or throat. Glass flow on such units is 100 per cent surface lateral, but abnormally high pulls are being obtained.

Among patents pertaining to the glass industry is an idea involving the use of air or other gases bubbled up from the tank bottom across the furnace at or near the hot spot of a conventionally operated furnace. Figure 8 illustrates this idea and it is felt to be very worthy of consideration. Overcoming of the mechanical forces, now working, are offset by the creation of a more power-

ful mechanical force. Flow of glass in the melter now reverts to a pattern which was supposed to be established by the temperature gradient shown in Figure 1. Influence of the bubble curtain is so great as to prevent a great amount of the short circuiting and recirculate the glass on the doghouse side of the curtain until it is melted. Dangers involved are evident. Should batch or stones be passed to the bridgewall side of the curtain before complete solution occurs, the time element is reduced by the speed of circulation.

Summary

(1) True convection currents are of secondary importance, having been supplanted in influence by powerful mechanical currents.

(2) The conventional temperature gradient on side port furnaces are working against rather than for good operation.

(3) Temperature gradients on end port furnaces generally tend to create lateral flow on the glass surface.

(4) Side port furnaces may be operated in such manner as to produce lateral surface flow and combat undesirable mechanical influences.

(5) Construction changes as well as other ideas may be instituted to provide a flow in furnaces which will assist in improved production.

(6) Flow in glass tanks will take place in the direction of least resistance or toward areas of minimum viscosity.

AMERICAN POTASH PLANS DISTRICT SALES OFFICES

American Potash & Chemical Corporation has announced plans to set up district sales offices in March at San Francisco, Calif. and Portland, Ore., to augment the company's sales activities in the western states.

The chemical company's San Francisco sales office, which will be located in the Russ Building, will handle sales in northern and central California, as well as Nevada, Utah and Colorado. The Portland sales office will cover Oregon, Washington, Idaho, Montana, Wyoming and British Columbia.

Announcement of the plans was made by William M. Clines, western sales manager, who said that opening of regional offices was a part of the company's current development and expansion program.

Rod Taft, previously supervisor of potash sales, will be transferred from Los Angeles to San Francisco as district sales manager, while Paul F. Staub has joined American Potash & Chemical Corporation as Pacific Northwest district sales manager, operating from Portland. Staub previously was district manager in Portland for L. H. Butcher Company for 10 years and, prior to that, was with General Chemical Division of Allied Chemical and Dye for 11 years as salesman and assistant sales manager of the General Chemical offices at San Francisco.

Recent additions to American Potash & Chemical Corporation's product lines include lithium hydroxide from its subsidiary, American Lithium Chemicals, Inc., at San Antonio, Texas; and chlorate and perchlorate chemicals from the recently-acquired Western Electrochemical Company, Henderson, Nev., which has been renamed American Potash & Chemical Corporation (Nevada).

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O-I ASSIGNS NEW POSTS TO TWO EXECUTIVES

R. C. Schwyn

E. D. Dodd

New assignments for two executives of the Libbey Glass Division of Owens-Illinois Glass Co. have been announced by A. M. Turner, O-I vice president and division general manager.

Edwin D. Dodd, production manager, was named factories manager, a new post, with primary responsibility for operating the Libbey glass plant in Toledo. He will also be responsible for Libbey's Buffalo, N. Y. plant, through B. L. King, plant manager.

Robert C. Schwyn, Toledo plant manager since 1949, has been named manager of production planning with responsibility for production forecasts and scheduling, and inventory controls. He has been assigned to division headquarters, Toledo.

Mr. Dodd joined Owens-Illinois in 1946, shortly after his discharge from U. S. Army service in World War II. He was public relations director of the company prior to his assignment as libbey's production manager.

Mr. Schwyn joined O-I in 1936, and served in several key manufacturing positions before he was made plant manager.

WESTVACO APPOINTMENTS

Three new appoints at Food Machinery and Chemical Corporation, Chemical Division, Central Research laboratory, currently under construction at Princeton, New Jersey, have just been announced by Dr. Emil Ott, vice president and director of Central Chemical Research ot FMC Chemical Divisions.

Dr. W. L. Davidson becomes assistant director of the FMC Chemicals Central Research laboratory. Dr. Davidson was formerly research director of FMC's Westvaco Chlor-Alkali Division with headquarters at South Charleston, West Virginia.

Dr. Hugo Stange becomes manager of the organic chemistry department of the FMC Chemicals Central Research laboratory. Dr. Stange joined FMC last September as a member of the staff of Dr. Carl F. Prutton, FMC vice president and technical director, Chemical Divisions, and was previously with the research department of the Olin Mathieson Corporation at Niagara Falls, N. Y.

Dr. S. C. Carniglia becomes manager of the inorganic and physical chemistry department of the FMC Chemical Central Research laboratory. Dr. Carneglia was formerly research director at the Newark, California facilities of FMC's Westvaco Mineral Products Division.

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MACHINERY

SOON TO BE AVAILABLE—1 Hartford-Empire Tong Stacker Type "M"; 2 Hartford-Empire Feeder Stirrer Mechanisms Type "98". Write Box 186, c/o THE GLASS INDUSTRY, 55 West 42 St., New York 36, N. Y.

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WANTED FOR EXPORT used Hartford-Empire Tong Stackers, Type "M", single stacking or double stacking. Please indicate price, delivery date and year of construction. Write to Transocean Industries, 541 Lexington Avenue, New York 22, N. Y.

EXPANSION PROGRAM PLANNED AT KAISER CHEMICAL

Kaiser Chemicals Division of Kaiser Aluminum & Chemical Corporation will undertake a three million dollar expansion program, which will increase its capacity to produce its refractory and magnesia products.

New facilities will be added to two of the division's plants—the Moss Landing, California, seawater magnesia plant and the Columbiana, Ohio, basic refractories plant now under construction. New equipment for the Moss Landing plant will double the present seawater handling capacity and will increase by more than fifty per cent its capacity to produce periclase. A large rotary kiln will be installed at the seawater plant. This will have a capacity of approximately 150 tons of magnesia products per day. New equipment at Columbiana will include additional pressing and materials handling facilities, which will increase the plant's capacity by fifty per cent. The Columbiana plant, presently under construction, is scheduled to be in operation by June 1 and additional facilities will be installed by January 1, 1957.

PILKINGTON APPOINTS UNITED STATES SALES MANAGER

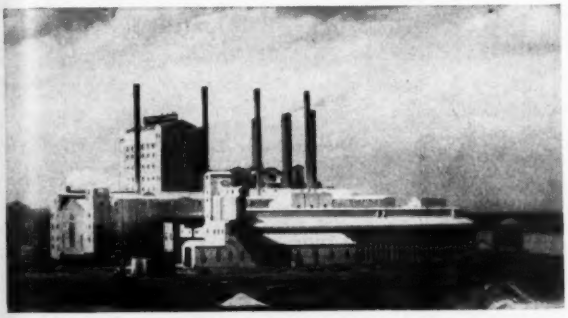
Pilkington Brothers (Canada) Ltd. announces that T. A. Paterson has been appointed sales manager for the United States.

Mr. Paterson is at present in the Glass Works, St. Helens, Lancashire, England, and will be taking up residence in Canada and his duties in the American markets within the next few weeks.

Milestones in Glass Progress

PHOTO COURTESY THE CORNING MUSEUM OF GLASS

1825 This sugar bowl is an extremely rare example of a particular branch of American glass—blown in a three-section mold, instead of the ordinary mold of two sections. The quilted and sunburst pattern shown is one of those most frequently found on this type of glassware.



1890 Michigan Alkali Company, now a division of Wyandotte Chemicals Corporation, was founded by Captain I. B. Ford to supply Soda Ash to the glass industry; part of Wyandotte's modern Soda Ash facilities is shown above. Wyandotte has literally grown up with glass. Today, as in the past, it is a working partner, supplying technical assistance and raw-material chemicals to those great companies marking milestones in glass progress.

Wyandotte
CHEMICALS

Wyandotte Chemicals Corporation, Wyandotte, Michigan
Offices in Principal Cities

Founded by a Glassmaker to Serve the Glass Industry

Research Digest . . .

(*Continued from page* 210)

were removed, the clay bottom was found to be untouched by glass, except where glass had intruded under the paving, near the throat, where nearly 2½ inches erosion occurred. The clay bottom blocks remained and were repaved with standard zircon dry, perssed brick for the next campaign. The previous campaign in this same tank, flint glass, ran 528 days, with interruptions due to the demand for glass. The vacuum cast clay bottom blocks were replaced after 280 days, with some of the second blocks still in good condition when the furnace was shut down for replacement of side walls and throat. On that fire, the tank melted 13,459 net tons of glass for an average of 9.8 tons per 100 square feet of melter area, or 54.7 net tons per square feet of melter per life.

Results to date in over 30 complete or partial installations, ranging in area from 10 to 300 square feet of melter, have shown that zircon paving is practical and economical where it is necessary or desirable to use a refractory other than clay bottom blocks, in order to balance the furnace bottom with potential life of the side walls and the other parts of the furnace.

Bonded zircon refractories have been used most effectively in the superstructure of continuous glass tanks as a separating media between silica and aluminum-silicate and several of the fused cast special refractories.

The wash or drip from a silica crown is readily soluble in most glasses, but after flowing over the hot face of the fused cast or high alumina refractories in the superstructure, the wash has picked up alumina or mullite and is less soluble. The products formed may contain nephelite, carnegeite, corundum, or similar compounds, all of which sources of stones and cords in the melt. Bonded zircon brick used as crown skews or as a drip course will minimize the effect of such silica crown wash.

Zircon brick and special shapes are also used effectively as peep hole blocks and port baffle blocks, particularly, when in silica masonry. As zircon is attacked by alumina-bearing slags or wash, best results are not obtained if zirvon refractories are subject to such conditions.

SHERWIN-WILLIAMS OPENS BARIUM CARBONATE PLANT

Opening of new barium carbonate production facilities at Coffeyville, Kansas, was announced by S. B. Coolidge, vice president and director of auxiliaries for The Sherwin-Williams Company.

The new plant has been set up in conjunction with the paint firm's 80-acre lithopone, leaded zinc and zinc sulphate production installation at Coffeyville.

Initially, Sherwin-Williams will produce about 7500 tons of barium carbonate annually. This is expected to be increased in the near future. Coolidge indicated that some of the product will be used by the paint firm itself for conversion to barium citrate, an ingredient of certain paints. However, the bulk of production will be made available to the glass, brick, ceramics and oil-additive industries as well as to other users of barium compounds.